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ABSTRACT

This book presents reports on selected "local action" projects that were developed as part of the Equity in Technology Project, which was inaugurated in 1985 by the Educational Computer Consortium of Ohio (ECCO). The book is organized into three sections, one for each of the populations targeted by the project. An introduction by Alice Fredman discussing the equity issue in general and overviews, also by Fredman, of the inequity potential for each of the three target populations addressed introduce the reports. The first two reports focus on girls; their titles are: "E(P) = ERG (Potential Energy = Enrichment Readiness for Girls: A Science/Computer Project for Sixth- and Seventh-Grade Girls" (T. Koontz); and "Sex Equity in Computer Education: An Enrichment Program for Seventh- and Eighth-Grade Girls" (J. Elliott). Minorities and economically disadvantaged students are the focus of the next three reports: "Equity Projects in Inner-City Schools: Working Together in Word Processing" (M. J. P. Boback and others); "Communicating with Computers: A Telecommunications Project" (V. J. Browsh, D. Hatfield, and J. M. Morgan); and "Using the Computer To Increase Academic, Vocational, and Social Skills of Junior High Occupational Students" (A. Fazzini). The last three reports focus on students with disabilities: "Computer Usage by Children with Learning Disabilities: An Exploration with First- and Second-Grade Students" (L. de la Pena); "The Write Way: A Language Arts Program for Orthopedically Handicapped Students" (L. Kuchmaner); and "Hands On--A Training Model for Peer Tutors" (M. Rosenshein). Learning activities, work sheets, a student survey questionnaire, and evaluation form for teachers are included in the project descriptions, and bibliographies of both the literature and relevant software are provided. (DB)

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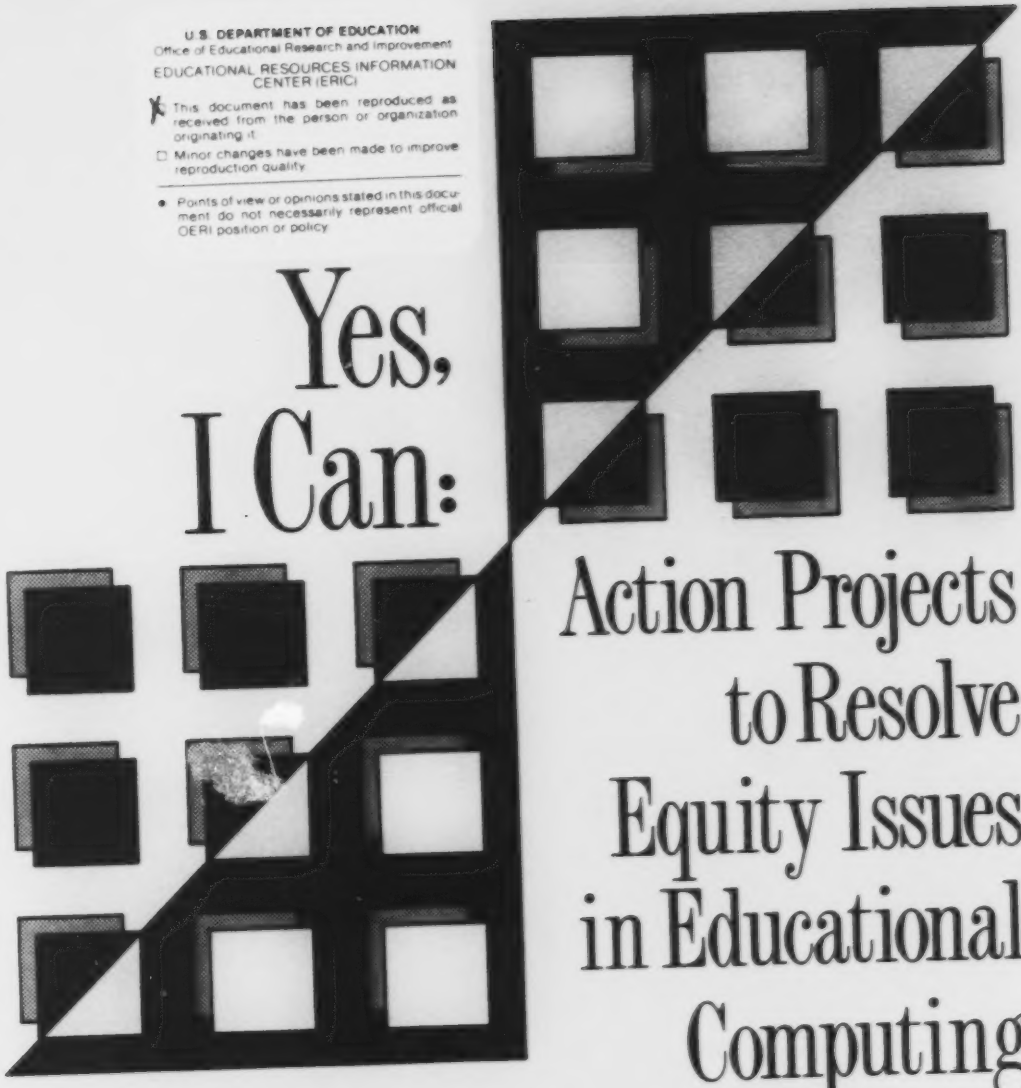

Yes, I Can:

Action Projects to Resolve Equity Issues in Educational Computing

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The Educational Computer Consortium of Ohio

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INTRODUCTION

The Equity Issue

by Alice Fredman

Equity is defined in Webster's dictionary as freedom from bias or favoritism. Inequity in a classroom situation, then, is the existence of bias or favoritism. Social and economic inequities have existed in public education in many forms. With the introduction of computers into the classroom, groups suffering past educational inequities now suffer one more, the technological inequity.

The recommendations of the National Commission on Excellence in Education in its 1984 report included new graduation requirements in the "Five New Basics." The "Basics" defined by the commission were English, math, science, social studies, and computer science. No one would deny that opportunities in the first four basics are available to all students (although for a variety of reasons, many students are systematically discouraged from pursuing studies in math and science), but our educational system strikes computer science two blows. First, in many schools, access to computers is limited to a small and elite group of students. This type of limited access is the result of administrative decisions. For example, an elementary school may limit computer access to the students in its gifted classes; or, a teacher may allow students to use the classroom computer only when they have finished an assignment—rewarding the swiftest and ignoring the neediest. A high school may require certain prerequisites or grades before a student can enroll for a computer class; or, computer courses may be available only as part of other courses, usually math. Second, even in schools where computer opportunities seem to be available to all, subtle forces are at work to deny certain groups of students meaningful access, or any access at all. For example, a computer club may be open to all students, but it is not uncommon for both boys and girls to perceive the computer club as the boys' domain. A programming class may be open to all, but poor math students who know the course requires programming math solutions opt not to learn to program. After-school computer activities are not available to students who are bussed. When computers are available to any student who shows proficiency in their use, the "proficient" students are often those who already have a computer at home.

Inadequately trained teachers, in an attempt to give their students an opportunity on the computer, may give them programmed games and rote drill and practice materials that do little to enhance their skills in any area, and do nothing to make them effective computer users who can access and process information. Students with poor reading skills often choose to stay away from computers because they do not understand the written directions. Those with poor spelling skills are often discouraged because the computer programs reject their misspelled input. Handicapped students may not be able to use a computer keyboard for input or may simply not be able to maneuver in a crowded computer lab.

The lack of opportunity to become computer literate segregates certain groups of students by denying them the use of effective tools for living in an age of computer information. The students who are most affected by these subtle forms of discrimination fall into four categories: females, economically disadvantaged, minorities, and handicapped. While the benefits of computers continue to multiply for many of our students, these four groups are in danger of becoming the victims of a new kind of segregation that separates the computer literate from the computer illiterate. Our society cannot afford to graduate students who cannot function in

the computer age; educators need to give their students the fullest opportunities to use computers effectively. Generally, educators do wish to offer these opportunities to their students. Sometimes they are frustrated by administrative policies; sometimes they lack the hardware or software to do the job. But most often, they are not aware of the subtle ways in which students are being denied computer opportunities.

In 1985, ECCO, the Educational Computer Consortium of Ohio, inaugurated a project designed to increase the participation of three target populations in educational uses of computers and to impact upon the educational and career options and opportunities for these groups. The target populations were females, minority/economically disadvantaged students, and students with either physical handicaps or learning disabilities. Funded initially by a grant from BP America, and subsequently through the Education for Economic Security Act and the Dwight D. Eisenhower Mathematics and Science Education Act, the Equity in Technology Project was designed to

- alert educators to the inequities that exist in their classrooms,
- give them strategies and techniques to overcome those inequities,
- give them an opportunity to put those strategies to work in the classroom, and
- help them serve as models for other educators.

During the first Equity in Technology Project, 12 "Local Action Projects" were funded. In the following project cycles, 45 additional Local Action Projects were added. Each project cycle began with an Educational Phase that consisted of training workshops conducted by national experts to raise the educational community's awareness of the inequities in computer education. Following the training phase, schools were invited to submit proposals, and the participating districts were selected. A telecommunications component was added to the project in 1989. Modems and software were given to every Local Action Project site, and project leaders were instructed in their use. Cleveland FreeNet, a free and open access telecommunication system operated by Case Western Reserve University in Cleveland, was used as the telecommunications network. A detailed description of the Equity in Technology Project can be found in Appendices A, B, and C.

The impact of the project continues to be felt, not only in the participating classrooms, but in other classrooms and schools where teachers and administrators have recognized the value of an affirmative computer equity program for their students. The Local Action Projects serve as models in the state for other schools that want to design their own projects, and several of the projects have been replicated in other settings. The insights that ECCO has learned throughout the years of the Equity in Technology Project provide the basis for this book, which is designed for those classroom teachers and school administrators who realize the importance of addressing the need to make equitable computer access available to all their students.

ECCO's Equity in Technology Project was designed to help teachers identify areas of inequity and to devise ways in which to address and alleviate them. We believe that the classroom teachers are in the best position to observe, first hand, how technological inequities are manifested and how they might be overcome. The projects were concerned with a variety of issues, student populations, and approaches. These will be discussed in the following sections. Certain common themes, however, emerged from the Equity in Technology Project. These are:

Theme 1: Changing Self-Perception

Many students had never used a computer before the project began. Some felt that computers were for the "smart kids" or for the "math whizzes." Others were in economic circumstances that precluded access to computers. Some students were inhibited by the thought of using anything electronic. Many girls viewed computers as part of the male domain. At the end of the project period, every project leader, without exception, reported that his or her students felt "comfortable" or "confident" using the computer. As each project developed, students began to see themselves in a new role, a role they formerly reserved for others. They manipulated hardware and software as easily as they did paper and pencil. (For some students with disabilities, the hardware and software *were* easier to manipulate than paper and pencil.) They were proud to produce neat and organized results. They experienced the universal satisfaction of accomplishment by striving toward a previously unattainable goal and overcoming obstacles to reach it. While some projects fell short of quantitative expectations, every project, without exception, met or surpassed the stated or unstated goal of raising students' self-esteem.

Theme 2: Changing Perception of Computers

Students involved in the equity projects generally perceived the computer in two ways at the start of the project: 1) as a scientific or mathematic machine, or 2) as a source of computer games. Their hands-on involvement in the various projects changed their perception of computers. The students no longer saw them as complicated electronic "brains" on one hand, or as electronic video games on the other hand. Rather, they saw the computers as one more tool in their repertoire of academic tools to enhance their ability to perform well.

Theme 3: Using a Word Processor as Motivation to Complete a Project

Using a word processor provided new interest in student assignments. Many of the students in the equity project, especially students with learning disabilities, were caught in a cycle of low motivation—poor work product, nonacceptance or criticism of work product, low motivation for next project. Although the computer did not in itself change the overall quality of the students' work, the potential of a clear readable output was a very motivating factor in helping students stay with a project.

Theme 4: The Importance of Role Models

Several project leaders brought community members into the classroom to serve as role models for the students. Role models were selected to reflect the composition of the

student body: for example, a female chemist in the ERG project, a science project for teen-aged girls; a Hispanic college student in the PREP project, a college preparatory project in an inner city school; a physically disabled secretary in the Write Way project, a communications project for students with handicaps. Project leaders reported that students reacted very positively to the role models' presence; they were asked many questions about their jobs and how they obtained their positions.

Theme 5: Changing Administrators' Views of the Role of Computers

Although no project's stated goal was to change the view of school administrators, such changes were reported by a majority of project leaders. Most project leaders had the wholehearted support of their supervisors and school administrators. Whether initially supportive or not, the fact that grant moneys were being directed to areas where computers had not been used before compelled administrators to evaluate the effectiveness of computers in those areas. In some cases, the equity projects garnered administrative support for further exploration of computers as a tool to overcome inequities. All of the project leaders devoted a great deal of extra time and effort to their equity projects. Their enthusiasm and willingness to continue the project beyond the funded period was dependent on administrative support.

Theme 6: Other Teachers' Involvement

Most project leaders reported that other teachers in their buildings, especially teachers of the same grade level or subject area, were interested in the equity projects. In many cases the interest was prompted by students not involved in the project who wanted to know what the students in the equity project were doing with computers. Their curiosity afforded the project leaders an opportunity to discuss the inequities and possible solutions. In addition to this informal dissemination of information, subsequent Equity in Technology projects have borne out the value of information dissemination and project replication. In 1988, 1989, and 1990, the Ohio Department of Education funded 45 additional Equity in Technology projects. New project leaders had the option of creating an original project or replicating one of the previous projects and adapting it to their students' needs. The enormous interest in replication showed that teachers were eager to adapt techniques with known results into their classrooms.

As we observed the various Local Action Projects, we noted that there were two distinct modes in the use of computers. In one mode the computer was used as a tool for its technological value.

- In **ERG** (Equal Enrichment Readiness for Girls), the computer was used as a receptor, analyzer, and recorder of raw data in a variety of science experiments.
- In **Communicating with Computers—A Telecommunications Project**, students used modems to communicate with other students across school boundaries.

In the second, more prevalent mode the computer was used as a tool to accomplish some other, nontechnical goal.

- In **Hands-On—A Training Model for Peer Tutors**, the peer tutors improved their self-confidence because of their new-found skill in using the computer and being able to help others in its use. They performed better not only in their computer classes, but also in other subject areas.
- In **Using the Computer to Increase Academic, Vocational, and Social Skills of Junior High Occupational Work Adjustment Students**, Occupational Work Adjustment (OWA) students were seen in a new light by the other students in the schools and were helped to raise their own self-image. Their work in other academic areas improved.

Some of the projects used computers both for their use as an instrument of technology as well as a tool to accomplish other academic and/or social goals.

- **Computer Usage by Learning Disabled Students: An Exploration** used the computer's combined audio-visual capabilities to promote language development as well as to give students with learning disabilities more self-confidence in their scholastic abilities.
- **PREP: Preparation for Success** used the computer to increase students' scores on the S.A.T. and A.C.T. tests.

Both modes alleviated inequities relating to our target populations. Self-image, perceptions by others, improvement in academic areas, and increased comfort with sophisticated technology were important outcomes of the Equity in Technology projects, particularly so since our target populations were often denied opportunities to achieve these kinds of successes. One of the most exciting outcomes of our projects was having participating students say, "I can do this!"

The book is organized into a section for each of the populations targeted by the project. Each section begins with an overview of the inequity potential for that population and the projects concerned with the particular inequity. The remaining chapters describe particular projects. References and resources for all projects are listed at the end of the book.

SECTION ONE

EQUITY FOR GIRLS

CHAPTER 1
EQUITY FOR GIRLS
An Overview

by Alice Fredman

Who is in the computer lab before school, during free time, and after school? Who is the computer hacker? Who attends computer camps most frequently? Who is most likely to have a home computer? If you answered "boys," you're not only right, you're aware of the manifestations of the sex-role stereotypes that have created the idea in the minds of many students, teachers, and parents that "computers are for boys." Although girls and boys use computers equally when classes are required, girls tend to drop out of the optional and more advanced classes. And it is precisely in these advanced classes that most technical work is done and that students acquire the needed prerequisites for higher level work. Concern is growing that without technical skills, girls will not be able to move on to advanced classes in computer science and will not be able to compete for high-paying jobs in the computer field when they graduate.

Many of the reasons why girls don't use school computers are subtle. In the article "Here's How You Can Help Girls Take Greater Advantage of School Computers," in the April 1985 issue of *The American School Board Journal*, Jo Shuchat Sanders, director of the Computer Equity Training Project at the Women's Action Alliance, New York, listed a number of factors that she said were at the basis of the computer gender gap.

1. The chicken-and-egg pattern: Girls consider computers unfeminine because they see mostly boys using them.
2. Girls stay out of the computer room because their girlfriends aren't there—an important social dynamic.
3. Schools often make computers available for optional use on a first-come, first-served basis, and boys, in their enthusiasm for the machines, aggressively capture the opportunities.
4. Most girls find Logo an interesting computer language, but most schools teach BASIC.
5. One student to each computer—the usual school arrangement—doesn't meet girls' needs for social interaction.

Added to this list is the fact that, in the minds of many students, computers are mathematical tools, and girls have typically avoided anything they perceive as mathematics. Much of the early software reflected an aggressive war-like image that girls avoided, and although software has vastly improved in this area, the perception remains. Advertising, too, contributed to sex-role stereotyping with pictures of males predominating in computer ads. And, finally, there was the often unspoken feeling on the part of some parents and teachers that computers are more suitable for boys than for girls.

Sex-role stereotyping is subtle. Before the training sessions, participating teachers weren't aware of the causes or results of this stereotyping or how they may have unwittingly contributed to it. The projects changed ideas of what is "appropriate" for girls in terms of taking science, mathematics, and computer science courses, signing up for computer time outside of regular classes, and taking a more aggressive stance in getting time on the computer. They changed ideas of how to present computer activities, making them more relevant to activities that seemed to interest girls and adapting them to girls' preferred learning styles. They changed career ideas, opening up options in nontraditional fields and college majors.

How did our project teachers accomplish this?

In **Sex Equity in Computer Education**, the teacher reported on the aggressiveness of the boys in her after school computer club. When the free period began, they pushed into the computer room and ran to the computers. The girls shrugged their shoulders, accepted the situation, and left. The boys liked the competitive and war-like games that the girls avoided. The situation fed on itself. The girls saw what was going on, stayed away, and the computer room became more and more a competitive macho place, truly for "boys only." The teacher, seeing what had happened, decided to intervene. Half of the computers were reserved for graphics and other creative activities. Girls were encouraged to work on cooperative projects. The result was a 50%/50% mixture of boys and girls in the after school computer lab.

The project leader in **Targeted Technology Teams** conducted a survey of home computers and found that parents usually bought computers for their sons, not their daughters, a finding confirmed by many reports in the journals. Students further reported that their fathers, not their mothers, used their home computers and used computers at work. To change the perception that computers are for men only, the teacher invited the mothers to participate in an after school program with their daughters. The results were positive, with mothers now able to reinforce school activities at home.

Adolescent girls in the **E(p)=ERG** project were concerned about their femininity. They were afraid to do something that seemed unsuitable to what "girls do." The teacher further found that the girls wanted a "cookbook" style of instruction. They were uncomfortable with the trial-and-error method the boys liked. This observation is consistent with studies that show girls tend to receive more direction from their parents than do boys who are often told to "figure it out for yourself." She began to encourage a trial-and-error approach, telling her students not to focus on the result, that it's O.K. to fail.

In **Communicating with Computers**, one of the classes was reporting their trip to the zoo. They were very enthusiastic about what they had seen and took a great deal of care in how they were communicating their information. They tried to say things succinctly; they were concerned about their spelling. Good learning was taking place. After 20 minutes it was time to sign off, and the students from one school signed themselves "Mike and Jed." According to the teacher, the girls who were sending the information from the other school "lost their cool." "We were talking to boys!" The teacher wondered if the communication would have been so open and free if the other students' gender had been known up front.

The equity projects changed ideas of what is "appropriate" behavior for girls. We learned that girls will sign up for computer time outside regular classes and take a more aggressive stance in getting time on the computer when they can do so as part of a peer group. Manipulatives and directed hands-on activities encouraged girls to participate in computer activities from which they formerly shied away. While most girls are reluctant to pursue computer projects individually, they are willing and eager to do so in the company of other girls. Although long-term results are not available, informal evaluations indicated that girls changed their career ideas and were much more open to pursuing nontraditional fields of study. Techniques that encouraged this thinking included using role models and the involvement of mothers or other female figures in project activities. Cooperative group projects were more appealing to the girls than individual projects.

In the next two chapters, two projects dealing with gender equity issues are described in detail. The readers can thus see how two teachers identified and created solutions for inequities resulting from sex-role stereotyping. One project deals with the need for adolescent girls to experience hands-on activities in science. The other project concerns itself more with how the girls in one school perceived the computer and how their teacher helped them to change their attitudes towards its use. There were a number of other projects that concerned themselves with sex equity issues. Many were based upon the common misconception that, given the same computer training in the classroom, boys and girls will have the same opportunities to pursue computers as tools in their future schooling and work. However, studies have shown that girls' interest in computers wanes with adolescence. Computers are viewed as boys' domain; a strong interest in computers threatens adolescent girls' perceptions of themselves as young women.

CHAPTER 2

$E_{(P)}$ = ERG (POTENTIAL ENERGY = ENRICHMENT READINESS FOR GIRLS)

A Science/Computer Project for Sixth- and Seventh-Grade Girls

by Trish Koontz, PhD

Abstract

Girls with a strong math and science aptitude traditionally drop out of the math/science/computer tracks by their junior year in high school. Parental and teacher expectations, peer pressure, and a narrow vision of future careers are some of the factors that can affect a girl's decision not to pursue high-level courses in math, science, and computer science. The ERG project was designed to change girls' attitudes about high-level science skills by involving them in hands-on, computer interfacing science projects in physics. Each week sixth- and seventh-grade girls explored a new aspect of physics through the use of computers and manipulatives. Topics included circuitry, rocketry, spatial puzzles, gears, temperature probes, and databases.

Participation in the ERG project sparked the girls' interest in science that should manifest itself in future school and career choices.

"Target Population" Profile

The ERG project chose a total of 20 females in the sixth and seventh grades (10 from each grade) who had demonstrated through tests that they were capable of using critical thinking skills. The initial population tested consisted of 26 sixth-grade females and 30 seventh- grade females who were selected for testing by their past grades in math and science. The Ross test of Higher Cognitive Skills and the Group Assessment of Logical Thinking (GALT) were administered to the 56 students to help the project leaders and school counselor identify the 20 females who would participate in the project. All of the girls tested were from upper-lower or lower-middle class families. After selecting the 20 girls, it was found that 19 of them had mothers working outside of the home at least part-time.

Goals

The main goal of this project was to provide intervention to create a more positive attitude in female middle-school-aged students towards technology, science, and related careers, and to increase enrollment in future high school mathematics, science, and computer courses. The following strategies/activities were planned:

(1) hands-on science projects in physics content areas (for example, heat, mechanics, and electronics)

(2) Experience with computer interfacing to discover uses for computers beyond drill and practice, and programming

(3) Communications with female role models through classroom visits, and on-site field trips to local business and industries to observe the scientific career environment.

Project Description

This section will describe in log format the units that the ERG group studied. Throughout the year logic puzzles, games, and spatial visualization activities were included to motivate and to increase the appreciation of the beauty of science and mathematics. Classes met twice a week. (*Editor's note: For purposes of clarity, the instructor's thoughts appear in italics.*)

September 10, 1986: Wednesday

First day of class—My objective is to introduce what we might accomplish this year.

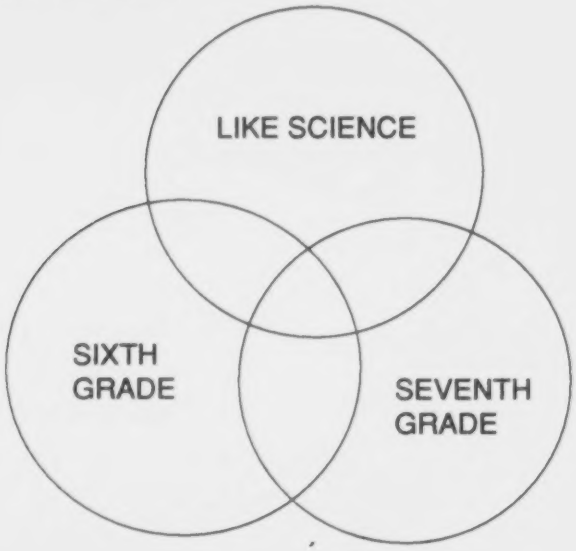
Girls enjoyed the activities. None had used a Venn Diagram and only one girl did it correctly. Explained origin of group's name—a concept known as potential energy since all of them were capable of being energetic scientists of the future.

ERG = work (dyne cm) = Potential Energy

ERG = Enrichment Readiness for Girls

Activities:

Venn diagram—Each girl is asked to sign her name in the appropriate space.



Cardboard box—Each girl got a cardboard pattern and had to make a cube by cutting, folding, and taping. Each got six blocks (1 by 2 by 2 units) to fit into the box so that the lid would close. Most accomplished task within five minutes.

Log—I told each girl to keep a log—what was happening, what they learned, and how it went.

September 15, 1986: Monday

Asked the girls to try to prove both mathematically and concretely that the blocks should fit into the box.

Venn diagram—Challenge: Identify the girl whose name is in the centermost region.

Candy saw that Kim was in the center region, so she asked all the girls to stand up. Candy asked the girls not wearing green to sit down (seven sat), then asked the girls on the blue team to sit (nine sat); there were three left standing. Candy asked those standing to sit if their birthdays were not in September, October, or November. Now only one girl was standing. Candy now knew Kim.

How does a computer work? **Binary number activity** using straws and cups.

To understand binary numbers, students should first understand how base 10 works.

Quick review of base 10 should include:

- The number of symbols is equal to the base name.
- When you have a group the size of the base, bundle it over to the next place value.
- Each consecutive place value is the next multiple of that base.

After reviewing base 10, start placing straws in the binary place value box one at a time, always placing the new straw in the "1s" cup. This process will demonstrate how each number in base two is written. The only two symbols used in base two are 0 and 1.

- If there are no straws in the box we write 0.
- Place one straw in the 1s cup and number is written as "1."
- Add the second straw into the 1s cup and try to guide the students to remember that you are not allowed two straws in the 1s cup; the two straws should be bundled as one bundle of two and placed in the "2s" cup. Therefore, two in base two is written as 10 (one bundle of two and no bundles of one).

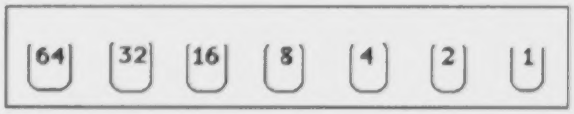
If another straw is added you now have three straws (one straw in the 1s cup and one bundle of two in the 2s cup).

Therefore, three is written 11 in base two.

Follow the same procedure to explain base two through the number 32.

From here we talked about the ASCII code and its relationship to the binary code.

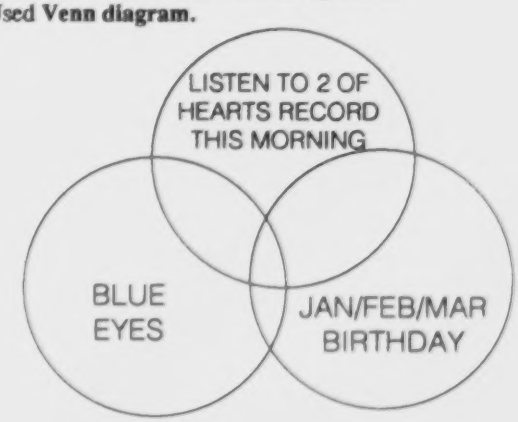
Binary Place Value Box



September 22, 1986:

Class brief—no time to write in log books.

Used **Venn diagram.**



4

Girls then picked numbers in lieu of their names and placed number in appropriate diagram space. Problem: Discover who is #13 by using logic (conjunction, disjunction, negation).

Returned to mathematical way of proving the block puzzle from first day. Only two suggestions made:

1. Calculate volume of the large cubic container and total volume of six blocks to the nearest hundredth place.
2. Volume of unit cube times number of unit cubes in puzzle. Wasn't quite sure if her logic was correct. *Am trying to get them to think and not wait for me to give the answers.*

Finished binary number writing. Talked about wires having on and off capability. How many possibilities of letters could be understood by the computer if there were only one wire, two wires, three wires, etc.? Girls saw the pattern quickly—seem to understand the use of binary code (ASCII) in the computer and the use of eight wires to make a byte.

Homework—write your name in binary code.

Three girls asked to quit the group—poor grades. Director of the Gifted/Talented program says this is common with pullout programs.

September 24, 1986: Wednesday
Girls chose partners by figuring out binary code names. Each seems competent reading and writing binary code.

New concept—static electricity balloon shelf, bending a small stream of running water with a comb and pith ball experiments. They all tried them out. Talked about electricity being a continuous flow, electrical pressure as Volts, current flow as Amps, and resistance in Ohms.

Connected a thin wire up to a six volt battery and discovered the wire melted.

They all seemed extremely involved. When the bell rang, they didn't want to go to the next class. When I asked what their next class was, six of them said science. One said, "This is fun science, not book science!"

September 29, 1986: Monday
Made **circuits** and learned the terminology and symbols.

Battery -
Wire —
Light O
Switch

Task 1: Use wire, one battery, and a light to make the light light up. Many circuit combinations made.

Task 2: Add a switch to above circuit. Much guessing—little logic, but I encourage guessing and checking too.

Task 3: Use two batteries and find two ways of connecting the batteries to the circuit in which the light shines differently in each way. Everyone discovered parallel and series circuits—then had to guess how it would be drawn using the symbols they learned earlier.

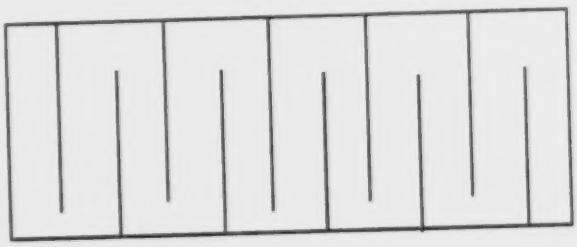
October 1, 1986: Wednesday
Task 4: Use wire, two batteries, two lights, and switch to discover brightest way for bulb to light. All participated eagerly, some got frustrated but persisted. By end of the class all understood concept of closed complete circuit. The girls traced the loop with their fingers. On Monday, they are to tell what a fuse or breaker is . . . look it up this weekend.

October 6, 1986: Monday
Started on the **Bit counters.** Sixth graders working on the computer doing the Electricity and Magnetism disk (map game), Rocky's Boots, and Electric Circuits disk—Seventh graders learning about LEDs, resistors, transistors, and how to read a schematic.

Tasks—Sixth graders are to use the three program disks—seventh graders are to find how to walk through one sheet of 8 1/2 x 11" paper using scissors, but not glue or tape. The seventh graders came up with two different ways to walk through the paper, so we started on directions of building a bit counter.

The puzzle was very motivating. They love the spatial visualization puzzles and the Venn diagram puzzles and ask to do more, but there's not enough time for more than one each day.

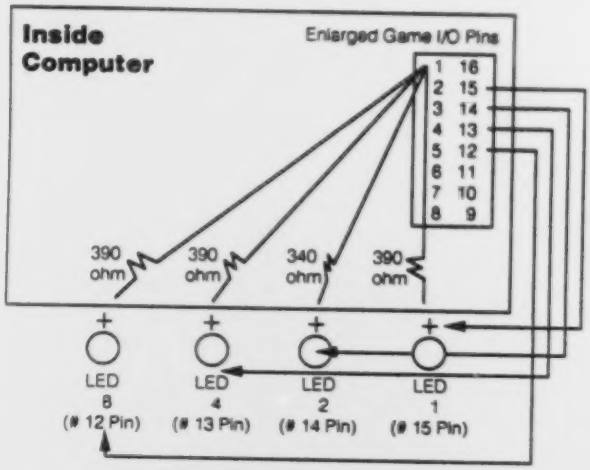
FOLD



1. Fold
2. Cut on dotted line
3. Open up and cut on all but end fold lines
4. Walk through

Introduced the vocabulary and symbols of resistors, LED, schematic, capacitor, ground, 5 volts, I/O, and the color coded ribbon cable, wire strippers, needle nose pliers, experimental (bread boards) boards. Discussed how top and bottom rows of the experimental boards are connected horizontally, but the A through J columns are connected vertically A-e and F-j. We'll start "stuffing" the boards in the next session.

There is much more personal ostracizing in the seventh grade than the sixth-grade group. Two girls are being avoided as the brains or, as they put it, "goodies." The most capable girl (IQ in the 150s) is able to hide her ability and still be liked. She does not volunteer any information unless called upon. Seventh graders seemed "out to lunch" when it came to detail; they'd rather have a gossip session.



Bit Counter Schematic for Apple Computer

Bit counter program: The students will input a number between 1 and 15 and the counter will light up the appropriate LED's to correspond to the binary code for that number. The Apple can have up to 5 LED's controlled but 4 were more than sufficient to demonstrate the concept.

```
10   A0 = PEEK  (49241):  A1 = PEEK  (49243):  A2 = PEEK  (49245):
     A3 = PEEK (49247)
20   HOME
30   PRINT:  PRINT "ENTER IN A NUMBER BETWEEN 0 AND 15 AND PRESS
     RETURN"
40   INPUT A
50   IF A>15 OR A<0
     THEN GOTO 20
60   IF A=1  OR  A=3  OR  A=5  OR  A=7  OR  A=9  OR  A=11  OR  A=13
     OR A=15
     THEN A0 = PEEK (49240)
70   IF A=2  OR  A=3  OR  A=6 OR  A=7  OR  A=10  OR  A=11 OR A=13
     OR  A=14  OR  A=15
     THEN A1 = PEEK (49242)
80   IF A=4  OR  A=5
     OR  A=6  OR  A=7  OR  A=7  OR  A=12  OR A=13 OR  A=14  OR  A=15
     THEN A2 = PEEK (49244)
90   IF A=8  OR A=9  OR A=10 OR A=11 OR A=12 OR A=13 OR A=14 OR A=15
     THEN A3 = PEEK (49246)
100  PRINT:  PRINT: "PRESS ECS KEY TO DO ANOTHER NUMBER"
110  ES = PEEK (49152)
120  IF ES = 155  THEN CL = PEEK (49168):  GOTO 10
130  GO TO 110
```

October 8, 1986: Wednesday
Sixth graders using the three electricity computer programs. They know how to read the schematic. Need to be reminded to write in their logs.

I know they do not understand the electronics, but my intentions are to get them to realize that they can do much more than they think they are capable of doing.

October 13, 1986: Monday
Sixth graders completed the "walking through the paper trick" and the circuit programs. Good understanding of parallel and series as far as the number of wires necessary. Working mostly on the **Electricity and Magnetism** program. Seventh graders putting in the wires connected to the LEDs—started by stripping the insulation off the tips of the wires.

Exercise: Read the resistors code (Bad Boys Rob Our Young Girls But Violet Gives Willingly).

A firm idea of place value is needed. Why you would need more resistance for some computer components than others. The girls related this to the wire we had melted earlier in our beginning work with series circuits. The color coding of the ribbon cable took a while for the girls to translate back to the experimental board on the schematic, but they did pretty well understanding the symbols.

October 15, 1986: Wednesday
Problem: Which resistor of the two used in the schematic, 82 Ohm or 1000 Ohm, should protect the computer and which one should protect the LED—the computer probably needed more protection.

Girls took turns wiring each part since we are wiring four bits (lights).

I am surprised how easily they picked up reading the schematic. They are a little more involved than at the beginning of the project.

October 20, 1986: Monday
The sixth graders are much easier to work with than the seventh. They still seem to have a social innocence that the seventh graders have lost. The sixth graders will ask questions and even give ideas that the seventh graders do not volunteer unless called upon. The seventh graders have mentioned aloud an unwillingness to appear smart or knowledgeable about a concept.

October 27, 1986: Monday
Seventh graders finished their bit counters and tested them.

Group I's didn't work until one girl discovered that a wire was touching another, short circuiting it.

Group II's didn't work until they discovered that all of their LEDs were in backwards. They didn't read the schematic correctly to look for the flat side of the LED. Girls were upset that I wouldn't tell them what was wrong with their counters when they didn't work, but I did give them a list of items to check. I wanted them to know that they had done it, not the teacher.

Group III's worked the first time they tested it. They all had a brief "Oh, this is great, I can't believe it works."

Started working with the sixth graders on the different names of the parts for their bit counters. They were already familiar with the resistor code from last week.

October 29, 1986: Wednesday
The seventh graders started on the programs while I continued to work with the sixth graders on reading a schematic.

Problems arising with how girls relate to class instruction—some want more direction (cookbook style)—others seemed to stay on task and seldom asked for help but did voice a few "I'm not sure why I'm doing this." Some approach activities more as games than from a problem solving concern. Only a few writing systematic notes but those who do are able to solve the puzzles more quickly.

November 3, 1986: Monday
Trying to get students to work independently without recipe-like directions—they need regular guiding questions. Sixth graders much more cooperative and willing to construct the bit counter than the seventh graders were. Perhaps I am clearer on second time around, or possibly, the social structure of each group laid the behavioral foundation.

No problems with ground wires, resistors, LEDs and transistors—did the color coding of the ribbon strip and experimental bread board last. Some problems following what was connected to what was read from the schematic.

November 5, 1986: Wednesday
Sixth graders are finishing bit counters—anxious to see if they work.

Two groups have no problem figuring out the last steps of spacing wires and making sure the LEDs were connected in the right direction.

Last group shorted out the computer power supply and couldn't get anything to work on the computer. We will have to work on it next week.

November 10, 1986: Monday
Started working with **Legos**. Girls were to construct anything they wished to get used to variety of parts since none of them had used the set with gears, universal joints, and other moving parts. Most made stationary structures.

November 17, 1986: Monday
Test on electricity and electronics. Then assigned a logic puzzle, Quibble's Cups, from *Aha Insight*. Students like logic puzzles.

November 19, 1986: Wednesday
Began work with motorized Legos.

Comments by the girls were "OO! We can make all kinds of neat gears," and "Look at the funny go cart I made. This is great."

November 24, 1986: Monday
Began to work with the **Lego Educational Curriculum.**

Activities:

Study the structures that would be stable.

Contest: Who could build the highest structure in a five-minute time period. Girls able to utilize what we talked about earlier. Worked well in groups when they were permitted to choose their own partners.

November 26, 1986: Wednesday
Started working with **simple machines—Lever**

Related it to everyday tools:
- paint can to open
- heavy cement block to lift
- scissors to cut

Discussed teeter-totters and levers, then tried to open the paint can focusing on the mechanical advantage of a lever. They generalized the relationship between the length of the lever and the advantage it gave. They made a pair of pliers and a lever to lift a heavy Lego block.

Lego provides picture cards on how to construct the simple machines. However, I did not want to foster a cookbook style laboratory, therefore, the cards were not used. The Legos seem perfect for learning concepts about simple machines.

December 3, 1986: Wednesday
Topic: **Gears**

Problem: Construct a gear train for experimentation. Gave each girl a Ziplock baggie with five different sized gears and assorted Legos.

Generalization: an odd number of gears keeps the motion going in the same direction. Started counting the number of rotations the first gear was turned (input), and the number of rotations the last gear made (output).

Most of the girls are working independently and seriously. When a gear train would break apart your could hear, "This is going to drive me crazy!"

December 8, 1986: Monday
Problem: Is there any relationship that can help us predict what the output will be if we know the number of rotations of the input gear?

Passed out a chart similar to the matrix worksheet in Sunburst Communications' *Gear* program—told girls to list the number of teeth of each gear on each axis of the chart. Many started looking for a pattern or relationship. Many didn't understand the value of a chart for problem solving. None of them saw the inverse relationship (e.g., 16:24 as 24:16) until questioning guided them in that direction. Completed the chart abstractly using a pattern and inverse ratio ideas, rather than using the Legos. One student brought in an old alarm clock for the other students to observe the gears moving.

December 10, 1986: Wednesday
Problem: Find a generalization about gears using the completed charts.

Gear Ratios					
# of teeth	8	14	16	24	40
8					
14					
16					
24					
40					

They saw the idea of the input/output ratio—didn't see the idea of a proportion right away. Use of manipulatives helped them understand—it's harder for them to use abstract reasoning. Proportion concept was easier to understand when applied to their 10-speed bikes.

Activity: Make an egg beater using Legos. Girls excited with this project.

December 17, 1986: Wednesday
Girls working on Lego "egg-beaters."

They discovered that they needed to use gears that were perpendicular to each other in direction. Some frustration, but they were encouraged by others' successes. Egg-beaters all different—girls are extremely creative. Many models were "strained." Comments—"Not exactly the best thing in the world, but it works."; "I don't care if mine is strained, as long as it works for a couple of seconds."; "This one doesn't come with a warranty."; and "We got a great one. Can we market it?"

January 5, 1987: Monday
New concept: **How computers help us design models for testing.**

Discussed how computers are used in industry.

Used *Toy Shop* from Broderbund to design a **helicraft.**

Some of the girls are having trouble with this activity—sticky paper placement, bending the wires to the right angles. They comment, "Please do this for me. I just want it done; I don't care if I can't do it." But they still did it themselves. Others enjoy the challenge and love helping the others. They seem to be able to do the more intricate parts and if they can't, they keep on trying until they do. They don't complain about the difficulty of it.

New Year's treat—another logic puzzle from *Aha Insight* called Quibble's Glasses.

Each group of three starts out with 10 glasses in a line. The first five are filled with Kinky Kola (I actually had the glasses and cola for them to use). The object is to move just two glasses to make a row in which the full and empty glasses alternate. *They love these puzzles. They are quick to solve*

them and are not modest after doing so. I encourage them to feel good about their creative solutions.

January 7, 1987: Wednesday
Continued work on helicraft—formed the wires, cut the models out, scored them with a razor knife in order to bend some of the pieces. Although some read directions, it seems easier to look at the already made helicraft. The wire bending seems to be causing the most difficulty—not used to working with tools. Those that did the best used the wire cutters and needle nose pliers. Those that decided to bend it with their own hands got even more frustrated when they first tried the tools.

January 14, 1987: Wednesday
Girls worked hard to finish their projects and have them ready to fly for next class. Top rotor construction too difficult to follow in the documentation, so I explained it to everyone at the same time.

Homework: Look up **Lift** and **Bernoulli's principle.** We then blew across a piece of paper (top then bottom). Only 5 of the 17 girls predicted the paper would go up. They were surprised that it didn't go down when air was blown across the top.

January 22, 1987: Wednesday
Began work on **database**—told the girls to ask their friends to fill out questionnaires.

Didn't finish the helicraft models—will have to fly them on February 3. Ten of the girls working well on their own and figuring out things for themselves. Five students working fairly well, but need regular help. Two have difficulty manipulating the tools and do not seem to improve. As their helicrafts are nearing completion, they are anxious to fly them and win "the small, dumb" prize as I refer to it.

February 3, 1987: Tuesday
Test flew the helicrafts in the gym. I knew the rubber bands would break after a few test flights, so had the contest with their first flights. Launched models three at a time—whose went highest and stayed up the longest.

Problems: Some threw it up with more force than others. Too much friction between the top rotor and the box itself. We used Vaseline to eliminate some friction, but the washers need to be glued down better.

Not really "scientific," but a good learning experience. Girls know how to redesign the helicraft and want to start on Thursday. However, we will go on to another unit.

Homework: A chemist from Monsanto Chemical Company is coming to class. Have at least one question ready for her.

February 5, 1987: Wednesday
Guest talked about science careers. Excellent speaker—brought a realistic picture for the girls. She made a point of calling them women (they were somewhat uncomfortable with this), telling them not to limit their courses whether it be in science or math, languages or sports, but do as much as they can while learning to budget time. The key was not to close yourself out of a career because of a limited background. She told a story about a business major and chemistry/business major trying for a job; "Who," she asked, "was more likely to get the job as an accountant or whatever in a technical company? Yes, the chemistry/business major." She also pointed out how often people change career plans. Taking a variety of advanced courses prepares us for whatever career path we may finally select.

February 10, 1987: Tuesday
Observed a vacuum sweeper keep a beach ball in the air.

Explained the formal definition of Bernoulli's principle using the girls in a demonstration.

Girls pretended to be air molecules that wanted to be alone and not crowded. Is this low pressure or high pressure? They loved being air molecules. We then had the girls explain how the ball could stay in the air using an angled force of air.

Experiment : Two ping pong balls hanging on a string four centimeters apart (side by side, but not touching). Had girls predict what would happen, then one blew between the balls. Result: The balls came together. Most had thought balls would go apart. I asked them to explain the happening by drawing a picture. They had a hard time conceptualizing where the molecules were going, but 13 of the girls were able to draw it correctly after some encouragement (not hints).

Began discussion of database using data girls had gathered from their friends. Talked about files, records, and fields, gave examples and applications of each. Groups started to design their PFS favorite files.

February 12, 1987: Thursday
Continued work on databases.

Girls decided what fields they wanted to use—most forgot a miscellaneous field to keep space open if they thought of something later. All of the teams (two to three girls) caught on easily to the idea. Most were able to type in about 8 to 10 records that included approximately eight favorite fields and the vital statistics (e.g., name, address).

I am giving them little instruction on how to design the file. I feel they will learn more from their own mistakes as we use the file.

February 17, 1987: Tuesday
Continued keying in records for the database. All catching on, but are somewhat unclear about how the sorting process will work.

February 19, 1987: Thursday
Problem: Search for a specific entry in a given field.

> Tried to locate a partial name by using the " . . " before and/or after a name.
> Used > and < signs.
> Discovered that the computer could sort for more than one field at a time.

Girls are able to translate the use of a database into real world situations:

> In industry for record keeping.
> In medicine to help with organ donor locations.
> For the periodic chart.

It is amazing that at least half of the girls (all in the advanced math group) got the signs mixed up, but still insisted that they knew how to use them. Abstract symbols are still not mastered at this age.

February 24, 1987: Tuesday
Showed the girls how to connect all three types of interfaces for the temperature probes: HRM through the I/O game port, Science Toolkit through the port in the back of the IIe and the MiMi card into slot 4.

Sixth graders not afraid to connect inside the computer—seventh graders said their computer literacy teacher said if they opened the computer "they'd get killed." We talked about grounding yourself and having the computer off before putting in the cards or interfacing probes.

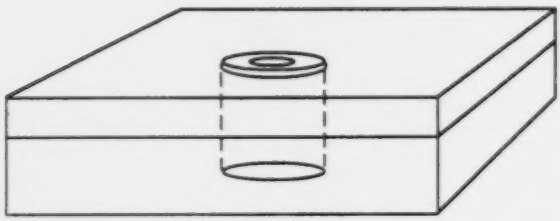
February 26, 1987: Thursday
Problem: What materials dissipate heat fast/slow?

Method: Girls listed materials: glass, clay, paper, cloth, metal, plastic, styrofoam.

They were then given hot water and cups to design an experiment that would measure the rate of heat lost by the cooling process through the different types of containers (those listed above). Girls mentioned the variables that should be controlled: thickness of container, size, amount of water, same temperature to begin with, same length of time (intervals) to measure heat loss.

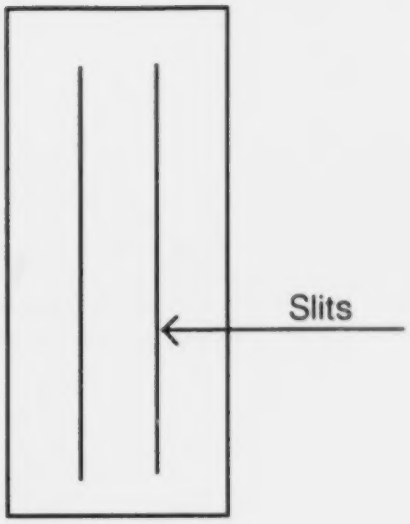
March 10, 1987: Tuesday
Problem: Trying to save an ice cube.

The hot plate got too hot and melted the homemade styrofoam cooler that was suggested by a sixth grader. The girls used coolers designed like the following drawing:



Switched from hot plates to heating pads. *(Suggestion: If I were a full-time teacher here we would let the ice melt at its leisure and not use the heat source.)* Each group tried out their predictions getting ready for the big "Save your Ice" contest.

Spatial visualization activity:
Each girl was given a 3-by-7 inch piece of oil cloth with two slits in it. They were told to braid the oil cloth in such a way that all the orange would be on one side and all the braiding on the other. Motivating activity. They finished the puzzle for homework.



March 12, 1987: Thursday
Final "Save the Ice" competition.

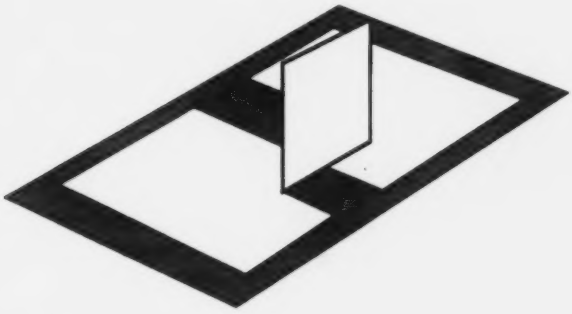
Winning team generalized that any insulating material that was not tight or compressed seemed to keep the ice "alive." They used large pebbles to absorb the heat, the large air spaces between the rocks kept the heat from transferring to the glass container (baby food jar) holding the ice. Even though rocks are not a good insulator, the way in which the group used the rocks actually used the air as an insulator. After the competition, we rank ordered the insulators and discussed properties of good insulators.

ERG—SAVE THE ICE CUBE!
What type of materials make good insulators for our homes? Perhaps we can find out by saving an ice cube.

1. List insulating materials.
2. Predict which materials will be the best insulators. List them in order starting with the best insulator.
3. Which variable might you want to control in deciding which material is the best insulator?
4. With your group, design an experiment that will determine which insulator is best to save the ice cube. Test each insulator with the homemade "ice box" and record your data below in a chart or table. You must take at least three temperature and time readings for each insulator. Label your chart or table.
5. How did the results of your experiment differ from what you predicted to be the best insulator?
6. Why might the best insulator not be used as an insulator in your house?
7. Graph Temperature vs. Time for each of the insulators on graph paper. You may color code the insulators. Label the graph and axis. What are the units of temperature and time you used?

March 17, 1987: Tuesday
Two spatial visualization puzzles:

1. Card game that had the girls matching four sides of a card to four other cards in order to make a 4 x 4 picture. There is only one way in which it will fit together. Only one girl was able to solve the puzzle, but it challenged and motivated the others. (Not available commercially.)
2. The second puzzle shown below was seen at an EQUALS workshop.



Objective:
Increase spatial visualization experiences while providing a motivating math activity.

Materials:
One sample taped onto a 4 X 6" index card for every four to five students
4 x 6" index cards
3 x 4"papers (different color than cards)
Scissors for each student
Transparent tape

Activity:
Using the colored papers (3 x 4") students are to cut the single sheet of paper such that it looks like the picture above. No taping is allowed until this product is finished.

March 19, 1987: Thursday
Another spatial puzzle—Pentominoes (described below).

I played the game by not telling them how many different configurations there are. I try to encourage the girls to take a chance if they think they have all of the configurations, but to also be reflective thinkers. As a student raised her hand, I would check first for congruent figures (flips or rotations) on another one of her drawings; if she didn't have all of the possibilities, I would say, "Jean has eight drawings, but there are more." This continued until they got all 12 figures correct.

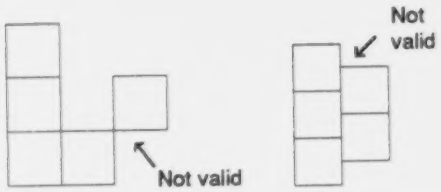
PENTOMINOES

MATERIALS
Five square regions, pencil, block paper, scissors

OBJECTIVES
Through a guided discovery experience, the students will utilize their spatial visualization ability in order to generalize some interesting mathematical ideas.

EXPERIMENT

1. Using all five square regions, how many different arrangements can you make? The entire side of one square must touch the entire side of another. If a given arrangement is flipped or turned (congruent figures), it does not make a new arrangement. How many different arrangements can you make?
2. How many of these arrangements are "boxmakers?" Hint: The box has no top. Use the scissors if necessary to verify your educated guesses.
3. Use all of the arrangements to fill the space (no overlaps) enclosed by a rectangular frame.



March 31, 1987: Tuesday
Analyzed two spatial puzzles:

1. Look at a three-dimensional object (an inch cube) and make a coat that will cover each of the cube's faces once and only once. The girls used inch graph paper for the coats. Many coats were alike—labeled them "K-Mart coats." More unusual designs similar to the pentominoes—called them "May Company coats."

Two girls able to break from the traditional frame of mind (using whole squares and those attached by complete edges) to cut out unusual designs—"Saks Fifth Avenue coats." (Examples at top of next page.)

They loved this activity. We designed 11 different coats in class. Many more can be made.

K-Mart

May Co.

Saks Fifth Avenue

2. Started on the **Nedbury Road Rallys** from *Off and Running: Computer Offline Activity Book*. Completed first two rallies. Girls found them to be fairly easy and were anxious to do more.

April 7 and 9, 1987: Tuesday & Thursday
Completed Rallies 3 and 4. Concepts (rules precedence, instructions, defaults, and scope of the rules) and importance of these concepts become clearer as they begin to play the more complicated rallies.

It amazed me that the girls did not think to use mathematics to help gather hints. But I felt suggesting this would distract from their discovering it on their own. The activities that they struggled through seemed to stick with them the most. Discovery learning seems to last. These are excellent activities and I suggest buying the book for the many other excellent activities included.

April 21, 1987: Tuesday
Began **Rocketry unit**:

Introduced new vocabulary words.

Gave students handout from Estes Educational Booklets to help them memorize the parts of the rocket and the safety rules. Girls excited at first, but not pleased that they had so much information to memorize in the next three weeks.

Performed experiments on:
(a) center of gravity (getting out of a chair without leaning forward)
(b) lift (Bernoulli's principle)
(c) thrust (using balloons)

They were told to study for a test on Thursday. No one would get her rocket unless she knew the parts of the rocket.

April 23, 1987: Thursday
After the test, each girl chose a rocket. There were eight different types of Level I (beginners) rockets. Girls paired up with whoever had the same rocket they had chosen. Spent 15 minutes making sure all the parts were there, reading the beginning of the directions, and sanding the pieces.

Whenever possible, the girls choose to follow someone else instead of reading their own directions. I think choosing a variety of rockets is harder for the instructor, but beneficial to the students. They observed many variables in the designs of the rockets and recovery systems. This project seemed easy for the girls, perhaps because of their experience with other hands-on building projects. Or perhaps they had learned that I would just smile and say, "I know you can figure it out with the help of the directions." Both seventh and sixth graders participated with equal eagerness.

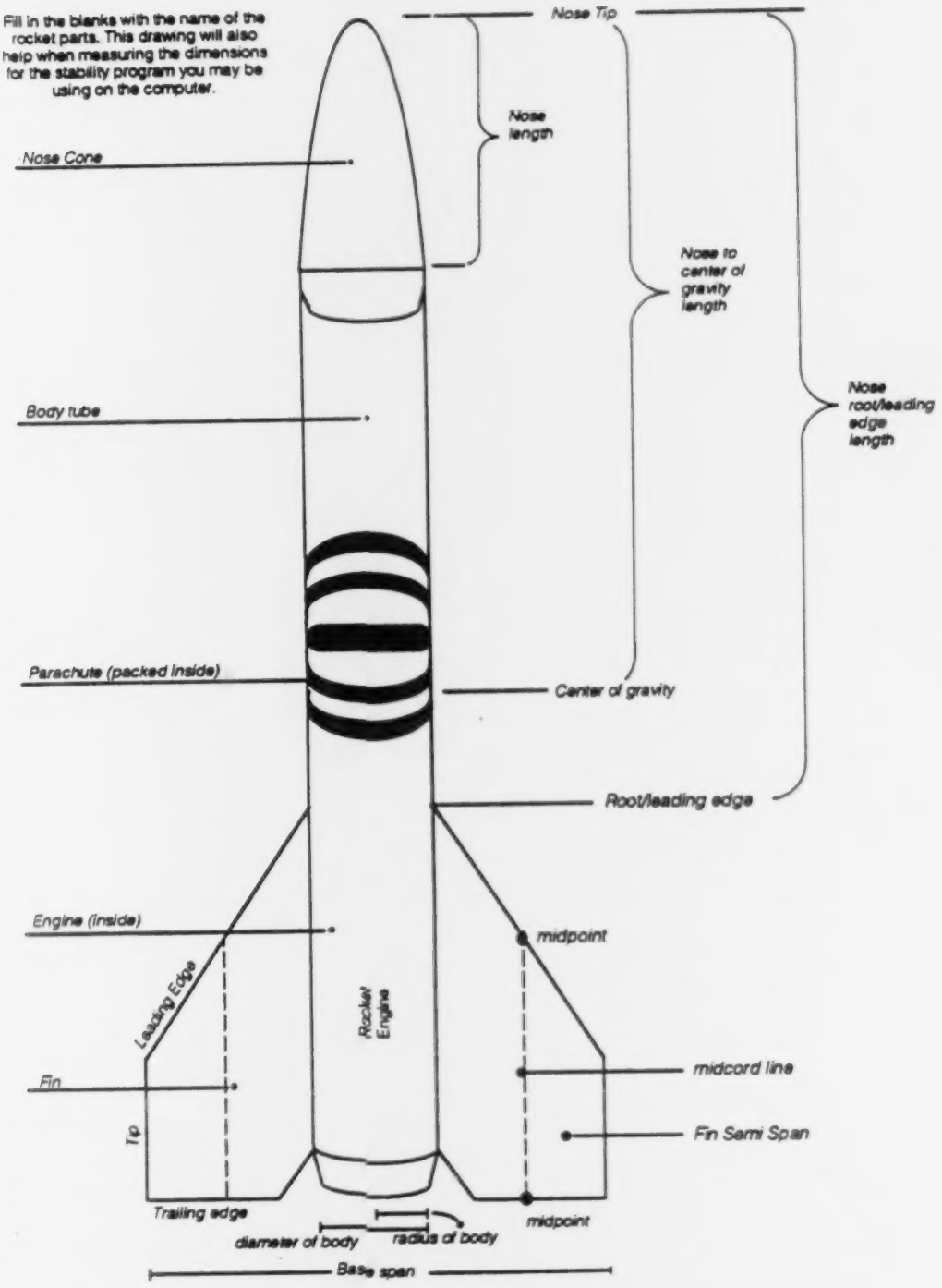
April 28, 1987: Tuesday
Lecture on rocket engines, thrust, and fin and nose cone designs. (Information clearly explained in the Estes documentation.) *As usual, they would rather be working with their hands than listening to a lecture/demonstration.*

April 30, 1987: Tuesday
Girls finished assembling the rockets and the recovery devices. Some had trouble understanding documentation and I finally decided to help (tell) since the documentation was meaningless to them.

May 7, 1987: Thursday
Painted the rockets. Color was important to them—most didn't want a white rocket "because it would get dirty as it fell to the ground after launching it." Talked about safety during launches and reviewed reasons for using wadding and the right size engine.

May 12 and 14, 1987: Tuesday & Thursday
Test on safety and then used the computers to test the stability of the rockets.

Handout to accompany the Stabcalc program: (The answers are included in this copy, shown on page 12, but were not for the students.) Fill in the blanks with the name of the rocket parts. This drawing will also help when measuring the dimensions for the stability program you may be using on the computer.


Fill in the blanks with the name of the rocket parts. This drawing will also help when measuring the dimensions for the stability program you may be using on the computer.
Nose Tip
Nose length
Nose Cone
Nose to center of gravity length
Nose root/leading edge length
Body tube
Parachute (packed inside)
Center of gravity
Root/leading edge
Engine (inside)
midpoint
Leading Edge
Rocket Engine
midcord line
Fin
Fin Semi Span
Tip
Trailing edge
midpoint
diameter of body
radius of body
Base span

Task Card

ROCKET DESIGN WORKSHEET

Problem: Explore the parts of a model rocket and their functions.

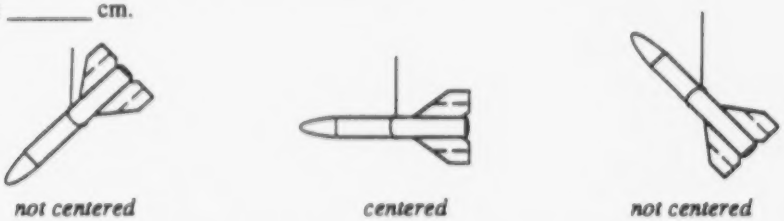
Materials: Supplies and kit to build model rocket, *Stabcalc-1* program, Apple computer, metric ruler (cm).

Investigations: You are to build your rocket according to the instructions or design your own; then enter measurements into the computer using the Stabcalc-1 program. The program will use the input data to calculate and determine if your rocket is stable enough to fly.

Part 1.

1. Build your rocket recording the following dimension:
   a. nose length _____ cm
   b. base span _____ cm
   c. length from nose tip to balancing point (center of gravity _____ cm)
   d. length of fin: root edge _____ cm
   e. length of fin: tip edge _____ cm
   f. fin: semi-span _____ cm
   g. length of fin: mid cord line _____ cm
   h. length of fin: leading cord line _____ cm
   i. diameter of body _____: radius (1/2 D) _____ cm
   j. body length from nose tip to root/leading edge _____ cm
2. Find the center of gravity or balancing point by letting the rocket hang from a loop in a string. Move the string until the rocket hangs parallel to the floor. See pictures below. Mark where the string is on the rocket. Now measure in centimeters the distance from the nose tip to the center of gravity.

   Record this: _____ cm.



not centered *centered* *not centered*

3. Is the nose tip conical (pointed), ogive (slight curve to pointed end), or parabolic (slightly rounded). See pictures.

conical *ogive* *parabolic*

4. Run the program, Stabcalc-1, answering the questions. If this is your first rocket, you will probably not have any transitions. Is your rocket stable?
5. If your rocket is stable, choose one of the dimensions above (a -j). Keeping all but that variable constant, find its limits (how large or small it can be and still keep the rocket stable).

   Using the Stabcalc-1 program, design a way to find these limits._____
   Key in all but one dimension as constants.

   Start to decrease the length of this chosen dimension by 0.5 cm and rerun the program. Continue doing this until your rocket is said to be unstable.

   Record this length in cm.:_____. Now increase the length by 0.5 cm beyond the initial value until it is again unstable.

   Record this length in cm.:_____.

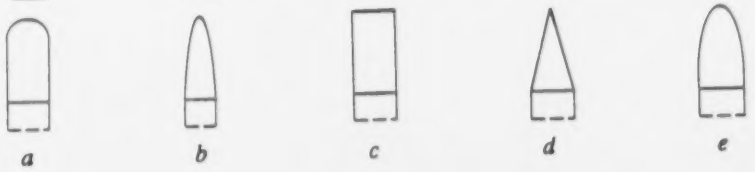
6. What type of fuel is used in the rocket?

7. Before launching your rocket with an electrical ignition system, how far should you be from the launch pad?

   At least _____.

8. At the speed your rockets will be travelling, order the best to poorest nose cone design shown below by placing the letters in the spaces below.

best _____ _____ _____ _____ _____ poorest



a *b* *c* *d* *e*

9. In order to eliminate as much drag as possible, what are some of the factors to consider?

   _____ cylindrical body, smooth surface, round-out, or

   _____ slope the base and a small cross-sectional area?

10. Name the four forces that can act upon your rocket as it is flying in the air.

    _____, _____, _____, and _____

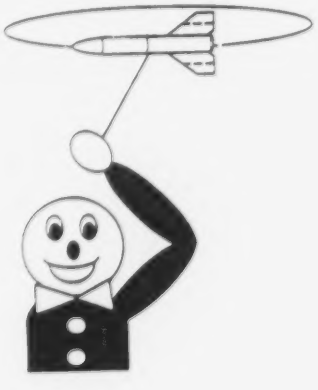
11. What part of the rocket gives it thrust?

12. A force that slows the forward motion of a model rocket is called _____.

13. Why are fins necessary in the design of the rocket?

14. What is your recovery system?

15. Perform the following stability test and see if the computer program and this test agree that your rocket will be stable during flight. Place a string (18-20 cm long) with a slipknot at the center of gravity mark on your rocket. Use masking tape to keep it in place. Now swing the rocket in a circular motion. A smooth straight motion indicates a stable rocket. Unstable rockets need to have weights added or modified before launching should occur. See demo.



Once again I was surprised with their lack of applications in mathematics. When they needed to find the diameter of the circular tube, most of them wrote the perimeter measurements instead. The computer did not seem exciting to them. They only wanted to launch the rocket. If we had time, I would have had them make hypsometers to measure how high their rockets flew. However, we need two class periods to launch and that is all we had left before posttesting time.

May 19 and 21, 1987: Tuesday & Thursday
Launching day! Everything they had waited for and then some. Everyone launched her rocket twice. There was even a comment about the electronic launch pad we used. One girl stated, "Oh, we have to complete the circuit like we did at the beginning of the year with the lights." I guess some of the information is still floating in their heads.

May 26, 1987: Tuesday
Our last class. I passed out awards made with Certificate Maker and copied them on parchment paper. They were impressed. They even wanted to know if they could be in ERG next year.

May 28, 1987: Thursday
Posttested all of the original girls with the GALT test, an effective test, and the essay about what I will use a computer for when I am 30 years old.

Evaluation

The main goal of this project was to provide intervention to create a more positive attitude in female middle-school-aged students about technology, science, and related careers.

The following strategies/activities were planned:

1. Hands-on science projects in physics content areas (e.g., heat, mechanics, and electronics);
2. Experience with computer interfacing to discover uses for computers beyond drill and practice, and programming;
3. Communications with female role models through classroom visitations and on-site field trips to local business and industries to observe the scientific career environment.

The goal of creating a more positive attitude toward technology and science in middle-school females seems to have been accomplished. Informal surveys were conducted at the end of the pilot year with the ERG participants and the control group, scholastically matched females who did not participate in the project. This comparative information will be presented later in this section. However, it must be stated that the critical evaluation cannot occur for another three to four years. Only then will we know if the ERG participants take more advanced high school mathematics, science, and computer courses than the control group.

It is the intention of the ERG project director to keep records of the physics enrollment at the high school each year. It is hoped that the girls who participated in ERG will enroll in physics their junior or senior year, thereby increasing the number of females in the physics classes. In the 1985-86 school year when the ERG project was first proposed, there was a total of five girls in two classes of physics taught at the high school.

It is also hoped that the number of girls enrolled in the advanced computing course will also increase as a result of this project. The number of females in the advanced computing course is usually less than or equal to that of the physics enrollment.

Evaluation of Strategy 1
Hands-on science projects in physics content areas.

A list of the content areas studied are summarized below. Table 1 shows the participants' attitude toward each unit in the project. The girls were asked whether the projects were *interesting* and *understandable*. They were then asked to rank order all of the units from favorite to least favorite (1 for favorite, 12 for least favorite).

Table 1
Likes and Understanding of ERG Units by Participants

	very interested, understood	OK	not interested, understood
1. Wiring parallel & series circuit	5	6	6
2. Computer programs about circuits	3	8	6
3. Building Binary Counter (Lights)	5	8	4
4. Building simple machines w/legos	10	7	0
5. Puzzles & manipulative games	16	1	0
6. Building gears with Legos	7	10	0
7. Gears—computer program	4	6	2
8. Databases	14	3	0
9. Building helicraft (Toy Shop)	9	8	0
10. Building and launching rockets	17	0	0
11. Rocket stability using computer	4	9	3
12. Temperature probes (ice alive)	5	5	7

The summary of the rank ordering of the activities from most to least favorite follows:

1. Building and launching rockets
2. Spatial Puzzles and manipulative logic games
3. Building Helitrope (Toy Shop)
4. Databases
5. Building simple machines with Legos
6. Building Gear projects with Legos
7. Gears—computer programs
8. Temperature probes (keep ice alive)
9. Rocket Stability—computer program
10. Wiring parallel and series circuits
11. Building a Binary Bit Counter
12. Computer programs for circuits

Scanning the rank ordering above, it became apparent that the hands-on building of models was more interesting and perhaps more understandable to the students than the computer programs (numbers 7, 9, and 12). The programs were all in a game format that the students liked, however, manipulatives have always been motivational and an appropriate format in which to learn about the world. In this case, manipulatives seemed to be more acceptable than the well designed computer programs.

One computer activity high on the list was databases. The file created to learn about databases was a "dating service." This proved to be very motivating for this age student. The activity was followed by a session on where databases could be used in science. During the discussion, students were astute in their transfer of how a database is created to other possible uses of the database. Even more important was the frequency that databases were mentioned when asked, "How will you use a computer in your life when you are 30 years old?" The students wrote this essay the last week of the project, nearly four months after the unit studying databases. Fifty-six percent of the ERG participants mentioned using databases in their future jobs, yet only 6% of the control group made such a comment. The citing of database use was substantial in that they were mentioned in reference to medical, managerial, and engineering type occupations. Many of these were not discussed during the ERG classes.

There is a possibility that rocketry was the highest on the list since it was the last unit studied and therefore still fresh in their minds. The least interesting, ironically, was the first unit studied, electronics and circuits (numbers 10, 11, 12). It may be important to note that the discovery approach used by the project director was new and frustrating to the students at first. The girls often stated, "I don't care to discover the answer, just tell me!" Fortunately, these comments lessened as the year progressed.

At the end of the test on electronics and electricity, students were asked to write a paragraph on "How did you feel when your binary counter interfaced to the computer worked?" None of the students gave negative answers. Sample responses follow:

Student 1:
I felt like I could really learn to hook up more complicated circuits. I was happy that we got it to work. It was really neat.

Student 2:
First I felt proud to be in ERG and that it worked and I took part in it. I didn't really understand some things about it, but I understood a lot, and what I understood, I thought was interesting.

Student 3:
I really liked when our binary counter worked. I felt I really made something that worked. I hope we do something like this again.

Because the students were working with many advanced electronic ideas and devices (resistors, transistors, LEDs, ground, resistor code, etc.), the intent of the activity was to encourage the female participant to feel that she too could build and fix electronic equipment, usually seen as a male task or accomplishment. Understanding the theory behind all of the components was secondary. Therefore, even though it ranked low on the list, the activity, according to the paragraphs, accomplished what it was designed to accomplish.

Evaluation of Strategy 2
Experience with computer interfacing to discover uses for computers beyond drill and practice and programming.

There is some question as to the success of this strategy. Two units involving interfacing the computer were studied. The first, a homemade bit counter, was mentioned in the first section of this evalustion. The second involved interfacing temperature probes to the computer to study insulators and the process of designing an experiment. When evaluating this section, it is difficult to speculate reasons for the students' lack of motivation for this unit. A number of possible suggestions are:

1. The unit was not designed for students of this age.
2. Compared to other activities, the computer is less appealing than other hands-on activities. That is, after seven months of participating in ERG, the girls showed a distinct preference for manipulatives such as Legos and spatial puzzles, and showed a strong indication that the computer activities were less interesting and less understandable.
3. During the period of time we were studying the unit on temperature using computer probes, students were feeling the pressures of special projects required of other subjects. Since this was a pull-out program, ERG became additional work. Grades were not given for this class, therefore, the students did not feel the same commitments to the units when there were other school obligations. Therefore, I would not recommend a non-graded replication of the project.

Other than the building of the bit counter and the interfacing of the temperature probes, problem solving games and tutorials were used whenever possible to enhance each unit. From comments during the lessons, the students enjoyed the game format of the computer for reinforcement of ideas, but did not rank the computer tutorials or games high on their preference list.

Evaluation of Strategy 3

Communications with female role models through classroom visitations and on-site field trips to local business and industries to observe the scientific career environment.

There is no way of evaluating the long-term effects a role model may have had on the students. However, questions asked by the girls during a session with a role model from Monsanto Chemical Company were not the type that would be asked in a traditional coed class. The questions show the necessity of providing role models. A sampling of questions follows:

What are some of the things you can do as a chemist?

How many girls were interested in science when you were a girl?

Did you get teased or made fun of because you were smart?

My brother is really smart. He got all kinds of math awards in high school and was in the gifted program, but he's a freshman at Ohio State and flunked physics. If he can't do it, how am I supposed to pass it?

Comments made by the girls for a few days following the speaker's presentation showed their feelings toward her were very positive. Sample comments were:

I thought she'd be some dull speaker, but she was great. Her job sounds interesting.

I feel like she said she felt when she was younger. The speaker was excellent.

Taking the girls to a research environment where female scientists worked was also thought to be an important influence on future career decision. However, many obstacles made a field trip impossible. The obstacles are discussed in the suggestions section of this document.

Evaluation Summary

Sixteen of the 20 original ERG participants completed a final evaluation. Another 33 females from the top sixth- and seventh-grade mathematics class took the same pre and post evaluations with the ERG participants. Three measurers were used to survey and evaluate. First, the Group Analysis of Logical Thinking (GALT) test was given to help match ERG participants to nonparticipants based on formal thinking ability in terms of a Piagetian framework. A second measure was a survey of attitudes about the importance of mathematics, computers, and science. The last consisted of completing an essay written by each student explaining how they would be using a computer when they were 30 years old.

Table 2 below shows the feelings of the 16 ERG participants (8 sixth and 8 seventh graders) compared to 16 control participants (8 sixth and 8 seventh graders) that were matched for ability to think logically as tested by the GALT test and the grade in which they were enrolled. Seventeen of the original 20 ERG participants remained in the program. One sixth-grade ERG participant was absent during this phase of the testing. Therefore, only 16 from each group will be compared.

The girls were asked how they felt about the following statements. They were to mark if they *Agree Very Much, Agree, Disagree,* or *Disagree Very Much.* The option *I don't know* (3 points) was not included because too many girls tend to choose that option if it is offered.

The scores were averaged with the following points assigned to each answer.

Agree Very Much	= 5 points
Agree	= 4 points
Disagree	= 2 points
Disagree Very Much	= 1 point

There were 13 other questions randomly placed on the test that asked the same questions, but were stated differently as a check. For example, number 7 was also stated as "There is little need for math in most jobs."

There are interesting findings that can be highlighted from the chart above. Even though the girls were matched for grade level, performance on a logical thinking (Piagetian) test, and math achievement as demonstrated by placement within the accelerated math class, the girls in the ERG class were less likely to state that boys are better in math than girls. The ERG participants responses were between disagree and disagree very much (1.50), and the control group averaged

Table 2
Informal Attitude Test Summary

	ERG	Control	Diff.
1. I like science.	4.50	3.88	+ .62
2. Science class is fun.	3.19	3.50	- .31
3. I like math.	4.06	3.75	+ .31
4. Math class is fun.	3.29	3.13	+ .16
5. Boys do better in math than girls.	1.50	2.81	-1.31
6. There are more men in science than women.	2.65	2.37	+ .28
7. Math is important to get a good job.	4.94	4.37	+ .57
8. Reading is important to get a good job.	4.75	4.37	+ .38
9. Science is important to get a good job.	4.13	3.75	+ .38
10. My mother is good in math.	4.06	3.62	+ .44
11. My father is good in math.	4.00	4.44	- .44
12. Dad uses our home computer more than Mom.	3.85	4.14	- .29

Table 3
Computer Uses at 30 Years Old
(*N* = 16 for each group)

USE	ERG	CONTROL	
1. Housework	4	4	
2. Homework for children	8	3	
3. Grocery list and recipes	8	7	
4. Entertainment (games)	5	7	
5. Control house environment	2	1	
6. Calendar of Events	4	3	
7. Calculator	4	4	
8. Word Processor	8	8	
9. Finances	6	7	
10. On the job or career	12	4	*
11. Use to design items, architect, etc.	11	0	*
12. Use to control machines, temp probes, etc.	8	1	*
13. Databases (medical, inventory, etc.)	9	2	*

* Indicated significant differences at 0.01 level.

between disagree and neutral (2.81) about the statement that "boys do better in math than girls."

Responses to numbers 10 and 11, "My mother is good in math" and "My father is good in math" show a second interesting trend. The girls participating in ERG perceived their parents to perform equally well in mathematics, mother 4.06 and father 4.00, whereas the females in the control group perceived their fathers as better mathematical thinkers than their mothers (mother 3.62 and father 4.44). This survey in no way proves or even suggests that participation in ERG influenced their thinking, but even though both groups' interest in math and science is fairly consistent, the control group was more inclined to accept male dominance in mathematics.

Computer Essay

All of the ERG participants and the control group were asked to write an essay describing how they would be using a computer when they are 30 years old. All wrote at the same time and location to guarantee directions were the same for each group. This type of question was never posed during any of the ERG sessions. Below is a list of how students perceived themselves using a computer and the number of different students in each group who made reference to computer usage.

This same essay was assigned to the sixth graders at the end of their fifth-grade year as a survey to show expressed needs for the ERG project. At that time, there was no significant difference between the girls who later went on to participate in ERG and those who did not. The reader may argue that only the sixth graders were surveyed and not the seventh-grade females, but the ERG director/instructor found no significant difference between the sixth- and seventh-grade ERG girls in any of the attitude surveys, therefore, it may be assumed that the responses would be similar. In fact, all of the tables in this document were initially calculated separately for the sixth- and then seventh-grade groups. Since no significant difference was found between age groups, the summary combines the age groups, however, a difference in actual classroom behavior was found between sixth and seventh graders and that will be discussed in the Informal Notes section.

Based on a Chi-Square test, there were four areas of significant difference:

1) using databases,
2) using computers to control other machines,
3) using computers to help design items such as homes, planes, and pieces of art, and
4) using computers in their careers in general.

Each one of these areas shows a distinct awareness of the capabilities of a computer and is felt to be a direct result of the ERG project. The ERG participants used databases, had the computer controlling the bit counter, and built a Lego car that was controlled by batteries. They also had the computer design the helicraft using the Toy Shop program from Broderbund, then assembled and flew the helicrafts. The computer was also used to predict the flight stability of rockets assembled by the ERG students. No special emphasis was placed on computers in the work place during the ERG program, but most of the girls were able to internalize the uses from the ERG projects built during the year.

In Table 3, there is a significant difference in the frequency with which the ERG group mentioned the uses of computers as compared with the control group. Using the computer to help their children with homework was cited by 50% (8) of the ERG females and only 17% (3) of the control group. Even though it was not a significant difference, it may suggest that the ERG group is more aware of the educational uses of the computer because of the educational gaming programs used for gear, circuits, and rocketry. It was interesting to note that 50% (8) of the ERG females and 43.8% (7) of the control group females stated that they would use the

computer to keep grocery lists and recipes. Most of the girls already think of getting married and raising a family as an important goal. This project never had any intentions of demeaning the roles of wife, mother, or homemaker; the project wanted to raise awareness of science career options. It seems to have accomplished that goal.

To summarize, four main outcomes were accomplished during the year-long ERG project:

- The girls are now aware of the many uses of computers in their lives.
- They know they are capable of working with electronics, rocketry, and other typically male-oriented projects.
- They know others expect them to do as well in math, science, and computers as their male counterparts. Along with this, they know there are people who support them in these efforts.
- Students' self-expectation rose.

Replication

Complete replication of this project may not be acceptable in many school districts since girls were in a "pull-out" situation to participate in this pilot study. The girls had to agree to make up any work they missed in their regular classes while attending the ERG class.

The ERG director wanted to try a variety of physical science units and spatial visualization activities with middle school females without the distraction or aggressiveness of males during hands-on activities. This way the capability of the girls could be better observed and the typical "helplessness" displayed by females during science laboratory activities would hopefully be lessened or eliminated with the absence of male students. Therefore, the pull-out program was implemented.

In the 1988-89 school year, one teacher from the middle school was trained by the ERG director in how to use the equipment purchased through the BP America equity grant. The training costs were absorbed by a grant from the Education for Economic Securities Act Program. The training included an update of physical science knowledge, a course in computer utilization in science classrooms including gender equity strategies, and an implementation period with assistance available. During the implementation of the project, the teacher used manipulatives, computers, and sex equity strategies while encouraging other colleagues to use the strategies and materials. With assistance from the ERG director, she helped other teachers to use manipulatives, computers, and gender equity strategies in the middle school classroom. The pilot study subsequently became the basis for three different 15-month teacher training sessions called **Technology in Middle School Science: Equity Issues**. It is hoped that these modifications of the original project design will bring on more long-term changes in the teachers, and that the materials purchased for the pilot ERG study will be incorporated into the curriculum.

Important features of the project to replicate are:

1. Include physical science units such as simple machines, forces, heat, sound, and light in the middle school curriculum.
2. Provide hands-on activities during the study of these units.
3. Use the computer to help teach science concepts whenever possible.
4. Encourage girls to perform as much of the activities as boys do.
5. Arrange double periods at least once a week to provide time necessary to perform the hands-on activities.
6. Provide female scientist role models from business and industry.
7. Avoid cookbook-style experiments; try to have the students design the activities using guided discovery.
8. Include activities that promote estimating, controlling variables, spatial visualizations, and proportionate thinking.
9. Keep high expectations of what your students can do and understand.
10. Walk around the classroom, asking questions, keeping the girls on task.

Additional Suggestions

This project showed the importance of concrete experiences necessary to understand many physical science concepts. On a regular basis students would try a concrete model of a concept such as gear ratios and beam as they said, "Oh, I get it now," or "Why didn't we do this before? This is great!" As mentioned in the evaluation, the hands-on activities were always rated as more interesting and more understandable than the computer counterparts within individual units. Therefore, teachers must be better trained in the use of hands-on activities for middle school students.

Another important aspect for successful replication is the time factor. It was very frustrating to conduct hands-on activities in a 42-minute time span. It took three to four minutes to start the class and another five minutes cleanup time since the classroom was used for other purposes immediately after the ERG class. In the remaining 33 minutes, it was difficult to conduct discovery-type lessons. An alternative may be to block mathematics and science in which math may be a double period Monday and Wednesday and science would be a double period Tuesday and Thursday. This would leave a single period for each on Friday. Having a double period for math and science once a week would help tremendously. Careful consideration must be given to the scheduling nightmare that may result, but single periods for science will only perpetuate lecture-oriented classes for most middle school science teachers.

It was intended that a mother of one of the ERG participants would help with the class as a paid educational aide in order

to promote more communications with parents and start a communications network, however, of the 20 girls chosen to participate in the ERG program, 19 of the mothers worked and the remaining mother chose not to work with the class. Fathers were not asked to work since it was hoped that the female working with the science concepts might prove to be an additional role model.

The project did, however, find many females in business and industry willing to serve as role models for the girls. It was also refreshing to find a number of industries willing to give their employees release time to talk with the girls at school, however, when asked if the girls would be able to tour the facilities to get some feel for the emotional climate and atmosphere under which a scientist works, the request was repeatedly denied. Sample comments from business and industry liaisons follow: "The girls wouldn't understand what we are doing here, perhaps we can send a speaker to your school," or "We are involved with some confidential research, so we would not be able to conduct a tour for your class." Other similar comments were repeated even after I explained the reasons the tour would be appropriate. We never were able to find an industry willing to give the girls a tour of the research or computer laboratories, but the speaker at the school was excellent.

It is important to keep the rest of the faculty who are interested in science education informed about your project throughout the school year. This lessens the chance of creating friction among those using an alternative science teaching style and those teaching traditionally. A sharing time usually helps all involved. If possible, try to share the manipulatives with other teachers and encourage others to use the new technology. This is not easy, but important.

It is important to remember that the project was not intended to be replicated in full. It was thought that a unit or two per year could be integrated into the middle school science curriculum with ease. Trying to incorporate all of the units in one year is unrealistic for a number of reasons. First, only physics concepts were studied. Second, the director of this project found it very time consuming to set up and tear down the demonstrations and hands-on materials. The time it took to collect the materials was sometimes overwhelming, and last, it was felt by the ERG instructor that the pace should be slower next time around. The students needed time to absorb some of the new content.

A final note, at this age (11 to 13 years old) the girls were hard to read. There were times when their body language and casual conversations expressed disinterest in a particular activity, yet when we were progressing to the next activity, they begged to work longer on the present task. At times, just the opposite would occur. They seemed very engrossed by the project just to abandon it minutes after its completion. The following demonstrates these mixed signals. After weeks of learning about motion and rocketry, and hours of meticulous work assembling and painting the rockets, the girls were anxious to launch them. Each girl launched her rocket at least twice, however, within minutes after the completion of the last flight, over half of the girls gave their rockets away. A week after that incident, they asked if they would be doing rocketry again next year. When the response was "probably not, others will get a chance," the girls expressed deep disappointment. In looking back at the final evaluations, rocketry was their favorite unit of study. Are they too old to keep the rockets (toys!) and too young to give up fun?

During the year, I observed that the sixth graders showed more interest than the seventh graders. The seventh graders had more of a tendency to drift during the hands-on activities to conversations about boys, makeup, boys, parties, boys, and rock groups. This is not to say that the seventh graders were not working on ERG projects. If the instructor casually walked around the classroom and asked probing questions about the projects the "hormoning" could be kept to a minimum. Seldom were the girls asked to get back on target. By May, it became more obvious that the sixth graders were following suit. To wait until high school to participate in hands-on science and computer activities is too late. Girls may never enroll in the classes and never realize their potential or science interests.

Student Survey

Now that we have completed a year of ERG, I'd like some feedback from all of you. To better understand what might be beneficial and fun for next year's ERG class, I'd like you to anonymously tell me about each of the units we studied. Please check the one that best fits your feelings. If you found the unit to be interesting and you basically understood the concepts check the first column. If your interest in the unit was only average and/or you didn't fully understand the unit then check the middle column (OK). If you found little of interest in the unit and/or you were confused about the concepts then check the last column.

	Very interesting/ Understand	OK	Not interesting/ Understand
1. Wiring parallel and series circuits	_____	_____	_____
2. Computer programs about circuits	_____	_____	_____
3. Building a binary counter (lights)	_____	_____	_____
4. Building simple machines with Legos	_____	_____	_____
5. Puzzles and manipulative games	_____	_____	_____
6. Building gears with Legos	_____	_____	_____
7. Gears—computer program	_____	_____	_____
8. Databases	_____	_____	_____
9. Building helicraft (Toy Shop)	_____	_____	_____
10. Building and launching rockets	_____	_____	_____
11. Rocket stability using computer	_____	_____	_____
12. Temperature probes with computer	_____	_____	_____

Student Survey

Below are sentences that describe how you might feel about school subjects and their importance to you. Mark your answers in the following columns:

Agree very much = AVM Agree = A Disagree = D Disagree very much = DVM

	AVM	A	D	DVM
1. I like science.	___	___	___	___
2. Boys in my class do better in math than girls.	___	___	___	___
3. I like computers	___	___	___	___
4. I like school.	___	___	___	___
5. Knowing about computers is important for a job.	___	___	___	___
6. My father is good in math.	___	___	___	___
7. In school, science class is fun.	___	___	___	___
8. In school, computer class is fun.	___	___	___	___
9. In school, math class is fun.	___	___	___	___
10. Science is my favorite subject.	___	___	___	___
11. Math is important to get a good job.	___	___	___	___
12. My mother expects me to get high grades.	___	___	___	___
13. No matter how hard I try I have trouble in math.	___	___	___	___
14. No matter how hard I try I have trouble in science.	___	___	___	___
15. Reading is important to get a good job.	___	___	___	___
16. Science is important to get a good job.	___	___	___	___
17. Math is my favorite subject.	___	___	___	___
18. When math is hard I often think "I can't do it."	___	___	___	___
19. My father expects me to get high grades.	___	___	___	___
20. Science is not very important in everyday life.	___	___	___	___
21. More men are scientists than women.	___	___	___	___
22. There is little need for math in most jobs.	___	___	___	___
23. My mother is good in math.	___	___	___	___
24. Dad uses our home computer more than Mom.	___	___	___	___
25. I like math.	___	___	___	___

CHAPTER 3

SEX EQUITY IN COMPUTER EDUCATION

An Enrichment Program for Seventh- and Eighth-Grade Girls

by Janis Elliott

Abstract

The target population of "Sex Equity in Computer Education" is located in a depressed Appalachian area that has one of the highest unemployment rates in Ohio and a high number of school dropouts. For generations a large number of students have accepted a future of menial labor or unemployment and welfare as the norm. Girls in particular rarely considered a future involving the use of technological skills. This project was designed to change the assumptions of seventh- and eighth-grade girls, their parents, and the community regarding girls' roles in a technological environment.

The project leader observed first-hand what the research shows: Boys were more aggressive in taking advantage of computer time, and girls rarely came voluntarily to the lab. To reverse this trend, several minicourses were held after school. Students were introduced to a wide variety of software and programming skills. Noncompetitive, cooperative activities that are especially attractive to girls were emphasized. The mini-courses attracted more and more girls throughout the year. By the end of the school year, they accounted for over 46% of students in the lab on a voluntary basis.

The minicourses were then incorporated into parent/child workshops. The workshops were very well attended; in fact, many parents who did not have children in seventh or eighth grade asked if they could attend the workshops. The project's culminating activity was a computer fair. Students demonstrated their facility with a variety of software programs and displayed newsletters, graphic designs, and other printouts of their work.

"Sex Equity in Computer Education" brought about significant changes in the attitudes of disinterested girls who did not see technology as a relevant part of their lives. Involvement in the project helped them overcome a distrust of the unknown and gave them confidence to explore the potential of computers.

Background Information

According to the Women's Educational Equity Act Program, equity is defined as:

> "the responsiveness of educational institutions and... personnel to the special educational needs, interests, and concerns of women that arise from inequitable policies and practices."

The new technology is open to all who acquire the skills necessary to use it. Though it is open to females, women tend to avoid the high-tech skills necessary to benefit from the computer revolution. According to Tim Erickson (1986) in *Off and Running: The Computer Offline Activities Book*, "equity in the classroom or in the home begins with paying attention." By observing students using computers, parents and teachers can become more aware of the problem that exists in the computer program. The observation sheet reprinted below offers a checklist by the American Institute of Research for observing activities around computers. By close observation, we can find many factors that exclude women from the benefits of the computer; then we can take appropriate action to solve the problem.

Observation Sheet

Student:

WORKING:
___ Alone ___With Partner ___With Group

BEHAVIOR:

___Helping Others	___Passively Watching
___Being Helped	___Waiting for Help
___Dominating Other(s)	___Daydreaming
___Being Dominated	___Other

When our district first considered our computer program, we did not think that a sex equity problem existed; however, in observing the students we realized that, in fact, we had a serious problem at our school. Although both boys and girls had equal opportunity to participate in computer classes, girls did not appear to have equal access to the computers. When a boy/girl team was at the keyboard the boy was in control of the keyboard and the girl passively observed the action. The girls seemed reluctant to take control of the keyboard and actively participate in the computer activity.

The problem of sex equity was also apparent during free computer time. Although both boys and girls had an equal opportunity to participate, only 10% of those in attendance were females. Where were the girls? Many had attended introductory computer courses and participated in computer activities; however, for some reason, few attended free computer time periods.

The target population in the project were females in seventh and eighth grade in a rural elementary school. Students had a full range of ability levels. Some of the students attended special education classes while others attended academically advanced classes. The majority attended regular junior high classes. Although all seventh- and eighth-grade students, boys as well as girls, were involved in the project, activities were planned that would appeal to the girls.

Many females tend to enroll in more traditional female courses rather than computer courses, or they passively observe rather than actively participate in computer activities. In previous years, attendance at free computer time at our school was approximately 10% girls and 90% boys. Those girls who did attend free computer time usually relinquished their free computer time, either willingly or unwillingly, if a boy wished to use their computer. Sometimes the boy would begin as a partner with the girl then quickly assume control of the keyboard. Our purpose was to relieve girls' anxieties concerning computer usage and to develop their self-confidence so that they would become active rather than passive computer users.

Goals

The goals of the project were:

1. To involve more female students in *active* computer usage by offering them activities to develop their self-confidence in using the computer. In many situations, females are passive observers rather than active participants in computer activities.
2. To increase female participation in free computer time. Although the computers were made available to both boys and girls in our school, the majority of students attending free time computer sessions were boys. When girls do attend free computer time, they should be able to feel comfortable wit the computer and take control of the situation.

Although the basic project goals were to help the girls, we did not want to create another inequity by excluding the boys, so all the students were included. We found that both girls and boys enjoyed the activities even though we had designed them around topics and interests that we knew would appeal to the girls. Thus all students were able to benefit from a project primarily aimed at female students.

Major activities planned for the project included:

1. Staff assessment at the beginning and the conclusion of the project.
2. Student survey at the beginning and the conclusion of each segment of the project.
3. Minicourses to introduce various software packages, such as MECC's *Puzzles and Posters, Print Shop,* and *Logo.*
4. Resources from *The Neuter Computer* and *Off and Running.*
5. Use of *Newsroom* to produce newsletters about project activities.
6. Computer fairs on various dates to enable students to "show off" their work to parents, friends, and community members.
7. Mother/daughter workshops to establish positive role models.
8. Production of a booklet containing information, comments, and sample products from the various minicourses.
9. Production of a videotape to record activities and progress of the equity project.

Project Description

The project began in the fall of 1986 with approximately 275 students participating in various activities. A student survey was administered to ascertain background information about each student's previous computer experiences and to determine how the students wanted to use computers. Surveys indicated that students had a wide range of computer experience, ranging from no experience to introductory courses at school and at the local college. Surveys also indicated that the majority of the students wished to learn more about

computers. The survey is discussed further in the evaluation section.

To keep costs down, we used software that could be duplicated—public domain programs, MECC software with licensing agreement for duplication, and other sources of software that could be freely copied as needed. Multiple copies of some commercial software were also purchased.

At the beginning of the project, two days each week were set aside in the computer lab for minicourses and for free computer time. The minicourse activities, designed to stimulate student interest, used software that did not require users to have highly technical skills. After students were introduced to the current computer topic in the minicourse, they were encouraged to share their computer experiences with a friend. Students were encouraged to "show off" the products from their computer projects.

Copies were displayed in the lab.
Graphics and computer designs were duplicated in a student booklet.
Computer fairs were held to display student projects, to demonstrate software used in the project, and to publicize the project.

Minicourses

Minicourse #1: Print Shop, Puzzles, and Posters. This minicourse involved the use of MECC's *Puzzles and Posters* and *Print Shop*. Students learned how to create posters, banners, and cards and then introduced the software to their friends. Though the *Maze*, *Crossword*, and *Wordfind* program were not formally introduced to the students, many explored these programs and were very excited about the personalized projects that they created. This software was used extensively during free computer time.

We purchased several copies of *Print Shop* intending to use it extensively throughout the project. Although the students enjoyed it, we did not get as much use from this software as was first anticipated because of the time required to prepare and produce a finished product. We did, however, use *Print Shop* for much of the local publicity for the project. MECC's *Puzzles and Posters* software produces a nice quality product and does not require as much time.

Minicourse #2: Computer Designs. Each student developed a computer design using the BASIC PRINT statement to produce a name or design on the screen. Designs ranged from simple names and initials to rockets and unicorns. Each student printed a hard copy of original designs and placed it on a personalized calendar, produced using a public domain calendar program. Many designs were included on a disk to produce a continuous display of the designs. The design showcase was included in the computer fair, and all the designs were included in the booklet *Computer Designs and Graphics*. The booklet was given to each student and staff member involved in the project and was made available to the public during the computer fair held at the conclusion of the eighth-grade segment.

Minicourse #3: Exploring Logo. Students explored Logo turtle graphics, creating unique Logo designs and procedures to develop more detailed designs. The girls especially were receptive to the development of intricate designs. Students' graphics were printed and included in our *Computer Designs and Graphics* booklet. Students were astonished at the lovely designs that could be created by so few commands. Some students, who were not doing well in other classes and who showed little interest in computers before this minicourse, were very proud of their Logo designs and did several extra designs "just for the fun of it." They were thrilled to find out that they could complete the project so successfully. They began to see "work" on the computers as great fun.

Minicourse #4: Solutions Unlimited. All eighth-grade students used selected problem solving situations from the *Solutions Unlimited* series. Following a short video introducing the problem situation, students worked with a computer program that helped them explore possible solutions.

- In *Do I Know Enough?*, the students became detectives who collected evidence to discover who has stolen a friend's bicycle.
- In *The Canoe Race*, a smaller, weaker canoe team must develop a strategy to beat a larger, stronger canoe team in a race.
- *Saving Energy* dealt with budgeting and energy conservation.
- *Who Says So* dealt with reliable sources of information.

The *Solutions Unlimited* series includes eight disks, one videotape, and a teacher's manual. Through educational television funding, this software can be duplicated as needed for use in the classroom. It was an excellent and economical source of software for use in this project.

Computer Fairs

During the year, two computer fairs were held which featuring demonstrations of software used throughout the project and displays of student products, including samples of students' work, the *Computer Designs and Graphics* booklet, and the computer design showcase. The fairs were held after school so that more parents and adults could attend. Visitors were impressed by items produced by the students and the relative ease with which the cards and banners were produced. They were very interested in the Logo and computer designs developed by our students. The computer fair was an excellent way to display student work and create interest in the project.

Parent/Child Workshops

As a special treat, parent/child workshops were held in May, 1987. Student projects were displayed and the software used throughout the project was demonstrated. Each parent/child team shared a computer to explore various computer activities.

In the workshops, parent/child teams used the computer to explore materials that the students had been using in the project. A wide variety of software covering many interests and ability levels were available. Our parent/child teams turned out to be either mother/daughter teams or mother/son

teams. It was a very positive experience for those attending. The students enthusiastically demonstrated their skills and encouraged parents to use the computers. The students' enthusiasm was contagious as they presented their newly acquired skills.

Evaluation

The Sex Equity in Computer Education project had two goals. The first goal was to involve more female students in active computer usage by offering activities to develop their self-confidence in using the computer. We evaluated this goal primarily by observation in the classroom and during free computer time. Original observation of student interaction during computer free time indicated that females were basically passive observers rather than active participants during computer activities. At the end of the project, the girls were more active participants and were very assertive in using their free computer time. They knew what activities they wanted to do, obtained the necessary software, and worked on their chosen activities during all of their free time. Before the project, the girls would often relinquish their computer time if a boy wanted to use it, however, after the project this no longer happened. The girls felt that their computer activities were just as important and relevant as were the boys' activities. The girls were willing to share computers and printers, but were no longer willing to step aside to let the boys use their assigned computer.

A student survey was administered to the participants to compare their computer experience both before and after the project. It, too, indicated an increase in active computer use by the female students. Gains were made in keyboarding, use of a menu, willingness to use the computer, and a knowledge of an increased variety of computer uses. The girls participated more in after-school activities and expressed an interest in signing up ahead of time in order to assure their computer access. The survey showed us that the girls were more confident about their computer skills and wished to use the computers.

The second project goal was to increase female participation during free computer time. This goal was evaluated by attendance records maintained throughout the project. The computers were made available for free time computer use one period during the school day and one session after school twice a week. The ideal situation would have been to have after-school free time available every day, but this was impossible because of scheduling conflicts.

In previous years, the attendance at free computer time was approximately 90% males and 10% females. By the conclusion of the pilot project, this had changed to 53.4% males and 46.6% females for the eighth graders and 59% males and 41% females for the seventh graders.

Because of the project's success, it has been repeated every school year. We believe that its continuation is essential to the development of computer skills by all junior high students in our school. The hardware and software purchased through grant funds continue to be used. Additional graphics software and hardware, such as joysticks, Koala pads, light pens, and graphics tablets will be added as funds allow. Since most of our software is public domain or through a MECC licensing agreement, new lab packs of various software can be economically developed for use with our students.

We would like to create a similar program for our elementary students so that they can also enjoy the benefits of our computers. During the computer fairs, elementary teachers were able to investigate the variety of software available to them. They were also able to see how readily students learn to use the computer. One of the side effects of this program is the interest it has sparked in our teachers, parents, and community.

Additional Suggestions

Selection of software is important in a project such as this. Much software is designed with a male slant and features competition, war, and sports. The software with a "shoot-em up" presentation does not appeal to most females. Girls seem to prefer programs for writing, music, and art. They want programs that offer practical uses rather than merely games. Software for this project was selected to include a variety of language activities, problem solving skills, and printer activities. The use of carefully selected software is important in drawing the girls to the computer lab during free time.

Parents are a major resource in solving the gender gap problem. Parent/child workshops and computer fairs are good techniques for involving parents in the computer program. Since the majority of parents who attended the workshops and the computer fairs were mothers, a positive role model of females as computer users was presented. Activities that involve parents are highly recommended in any attempt to alleviate the sex equity problem. Women who use computers in their careers are often excellent guest speakers. As you involve more active female computer users in your project, you will be offering a positive role model for your female students.

The computer lab arrangement is quite important to attracting girls. In the developmental stage at the junior high school level, girls tend to be more social and like interaction. To accommodate this need, schools should place computer equipment in small clusters rather than rows. Rather than have one student per keyboard, permit a small group at the keyboard. This encourages the interaction desired by girls, thus removing the feeling of isolation that sometimes occurs around computers. The computers in our lab are placed on large tables on the outer perimeter of the room. At most computer stations there is room for at least two students. At printer stations there is room for several students. Printer stations were usually occupied by several students working, talking, and enjoying computer activities.

Section Two

Equity for Minorities and Disadvantaged Students

CHAPTER 4
EQUITY FOR MINORITIES AND ECONOMICALLY DISADVANTAGED STUDENTS

An Overview

by Alice Fredman

In a library in a predominantly black school district, a teacher conducts an after-school computer class. The students are using a computer based science kit that measures the temperature of water as it reaches a boil both with and without salt added. They are graphing the results, first by hand and then with the help of a computer. Their graphs will show the difference that the addition of salt makes in the boiling temperature.

This sophisticated use of a computer is not the norm for students in economically disadvantaged school districts. Many studies have shown that these schools tend to use computers for drill and practice exercises in the basic skills while in the more affluent school districts, students are more likely to learn programming—either Logo, BASIC, or Pascal. Some critics illustrate the difference between these two activities as "learning to serve the machine" and "learning to control it." Drill and practice activities also do not take full advantage of the computer's power. Problem solving, abstract reasoning, writing skills development, music and art applications, telecommunications, simulations, and microcomputer based laboratories, are among the computer uses which wealthier districts regularly offer to their students.

The wealthier districts have more computers, more software, and provide more teacher training. Parents in high income areas, who tend to use computers themselves, are more likely to apply pressure to school boards and administrators to use funds for technology and training, and may even donate equipment to the school through their Parent-Teacher organizations. Parents in low income districts are not always aware of what technology can offer to their children or, if they are, don't have the clout or know-how to influence policy makers.

Students from poor districts are less likely to have computers in their homes than are students from wealthier districts. They also have less access to the school's computers after school hours. Because of economic problems, their schools frequently are closed after dismissal. Computer rooms are locked because of concerns about security. Bussing prevents many children from participating in after-school activities.

What we see is a new technological elitism separating the rich from the poor districts. A study cited in *Phi Delta Kappan* (Hersh, 1983, May) states that the concept of literacy has become more complex over the years. In the early American agrarian society, reading was the primary literacy requirement. As our economy shifted to an industrialized base, the growing complexity added the need for the literacy requirements of writing and mathematics. The new literacy of this technological age now requires a very different perspective. According to this study, literacy now includes the competencies of sorting, analyzing, and synthesizing. Since minority populations represent the majority of children attending low socioeconomic schools, technological illiteracy will relegate these students to low level, low paying jobs when they graduate or leave school.

As with girls, minority students see few role models to emulate. Computing is too often seen as a wealthy, white, male activity. Schools need to seek out minority scientists, mathematicians, and others in technical fields to visit their classes, enlarging their students' views of possible future careers. Software, too, needs to be carefully screened for bias. Today, there are increasing numbers of software packages with minority figures on the covers and included in the program.

Many minority, inner-city students are considered to be at risk. The November/December 1988 issue of *Electronic Learning* (Goodspeed) deals with technology and the at-risk student. The article states that technology can play an important role in reducing the number of at-risk students by providing an extremely effective learning environment for dropouts and potential dropouts.

For all the reasons stated above, the second target population for ECCO's Equity in Technology Project were minority and/or economically disadvantaged students. Inner-city schools, rural schools, and schools in regions that were experiencing an economic turndown were targeted areas.

Although we were aware of the benefits of developing projects in inner-city schools that would encourage increased computer use, we decided to focus on projects that would also accomplish other nontechnical goals. In **Working Together in Word Processing**, eighth-grade "editors" worked with fourth-grade "writers" to produce a book. The computer was a catalyst in the establishment of a big brother/big sister relationship with the older students becoming role models for their young friends. The teacher reported that both older and younger students showed increased self-esteem. In the **Acorn Project**, which used computer assisted instructional programs, the students were proud that they were able to use a sophisticated technological tool. Their attitude toward school changed. Students with behavior problems became model students. In **PREP: Preparation for Success**, the computer helped students prepare for S.A.T. and A.C.T. tests. Participating students were thus helped to equalize their chances for success on these tests and were able to raise their test scores. Minority college students were invited to help with the project. These students were role models and were believable when they answered questions about what the exams were like and what to expect at college. These three projects are discussed in chapter 5.

Chapters 6 and 7 describe two projects that attempted to overcome barriers faced by our target populations. **Communicating With Computers** used computers to overcome the barriers separating inner-city and suburban students. They were able to "meet" each other. For most of them this was the first time they had communicated with peers from other socioeconomic groups. In **Using the Computer to Increase Academic, Vocational, and Social Skills of Junior High Occupational Students**, economically disadvantaged students who were in the school's Occupational Work Adjustment program used word processing for their writing projects and instructional software to improve their basic skills. They served as computer assistants to students from other classes, thus enhancing their status and feelings of self-worth.

Why was a computer felt to be a necessary part of these projects? They could, after all, have been conducted in other ways. Pen-pal letters could have replaced telecommunications, and practice tests could have helped students prepare for college entrance exams. Computers offered prestige—students and parents both felt that what they were doing had value; it was important and unique. A paper and pencil approach was simply more of what wasn't working in the first place. These projects have been very successful, not only in accomplishing their stated goals, but in enhancing the self-image of the participating students and in enabling them to understand a wider range of computer applications.

CHAPTER 5
EQUITY PROJECTS IN INNER-CITY SCHOOLS

Working Together in Word Processing
A Summary

by Sister Mary John Paul Boback, SND
and Sister Geraldine M. Tengler, SND

Working Together in Word Processing created an Author-Editor Club, composed of teams of fourth-grade authors and eighth-grade editors, that created a booklet of short stories.

The target population for the project was approximately 30 junior high school students, girls slightly outnumbering boys with an age range of 12 to 16 years. They reflected the total student population of 57% Black, 24% White, 19% Hispanic. The school (Grades K through 8 with a total enrollment of 105 boys and 135 girls) is in a rapidly changing neighborhood. The majority of children come from single parent families, many of whom are on welfare and/or Aid to Families with Dependent Children. Those women who work generally earn little more than minimum wage. Nearly everyone is struggling. Especially among the Black students, the parents (mothers in particular) see our school as an opportunity for their children to better themselves, "to get what I never had." The Hispanic parents (most of whom have their roots in Puerto Rico) are protective of their young, especially the girls. They are not quite so eager to have the girls become involved with technology. However, the girls themselves are assertive, and once the youngsters master the challenge, the parents are won over and show great pride in the accomplishments of their children.

Within this milieu we perceived a special need for our students. We noted that minority and economically deprived youngsters would not and could not share in the benefits of a technological society unless they were comfortable with the tools of that society. And since the girls (especially Hispanic) would most likely be overlooked when computer training is available at home, we considered it incumbent on the school to provide as many opportunities as possible for girls to become familiar with computers.

At the outset of the project few, if any, of the students had access to computers outside the school. The homes are quite lacking in educational resources; those available are inadequate or outdated.

In the fall each fourth-grade student wrote a short story. His or her eighth-grade teammate typed the story on a computer. When the fourth-grade teacher marked errors of syntax or grammar, the fourth graders corrected their papers and the eighth graders edited the word processing documents. After all corrections had been made, authors and editors conferred with one another to plan their stories' layout. They chose fonts, designed title pages, divided their stories into pages, and created illustrations from graphics software for each page. Finally they merged the pictures with the text, colored them, and made books that were bound and copied for distribution.

Students' basic writing skills increased as they rewrote and edited their stories. The motivation for producing good writing samples was very high because the stories were to be published and read by a wide audience. Students were also motivated to use a variety of computer applications, both for their booklets and for other school and personal uses. An Author-Editor party, which included the students' parents, involved the family in the awareness of the importance of computers in the students' lives now and in their future.

Inner-city students who had virtually no contact with computers and their role in society have now experienced this technology in a very personal, meaningful way. Their introduction to technology was a positive experience that included planning, goal setting, teamwork, and commitment.

The Acorn Project
A Summary

by Thomas Diamantes

The Acorn Project (named for the 10 Acorn Computers on loan from ECCO) provided the opportunity for inner-city economically disadvantaged and minority students to participate in computer assisted language arts and social studies instruction. Goals of the project were to improve the students' reading skills and to increase parent involvement in school activities through computer workshops.

Students used the word processor to type short stories and answer reading comprehension questions. Those exercises enhanced their decoding, spelling, and editing techniques. The students answered the interpretive questions more freely with the aid of a computer than without it.

Some computers went home over weekends and holidays. Workshops were held to familiarize parents with the computers and to encourage them to use the computers when they were taken home. The workshops were very popular and attracted parents from other classes.

The project also developed important social skills. Students learned responsibility and cooperation. They not only shared and helped their computer partners, but also helped other students in all phases of computer operation.

Exposure to a high technology environment on a daily basis was very significant to the economically disadvantaged students. They saw the computer as a multifunctional tool with a natural place in their everyday lives. The project has changed some of the students' attitudes toward school and about themselves. School projects that were frustrating became possible and enjoyable. Students felt important and special having a computer lab in their room. The constant positive reinforcement the students received from the computer activities gave them pride in their work.

PREP: Preparation for Success
A Summary

by Marlene McMillan

PREP: Preparation for Success was designed to improve inner-city students' scores on the Scholastic Aptitude Test and America College Test by using tutorial software specifically designed for this purpose. There is a need within this school district to develop and to provide a program that will enable students to develop to their fullest capabilities. The district has many minority and economically disadvantaged students who need additional preparation in order to compete successfully on college entrance examinations such as the PSAT, SAT, and ACT. Traditionally, a low number of students take the entrance exams, and those that do score poorly.

The project's goal was not only to increase numbers of eligible students who take the exams and raise their scores, but to increase parent awareness of the benefits of test preparation, and to serve as a clearinghouse for effective preparation materials.

Once a week for 10 weeks, 11th- and 12th-grade students were scheduled into the computer lab to use self-paced software such as *Computer Preparation for SAT, Word Attack Skills*, and *Mastering the ACT* to become familiar with the exams' format and to practice the language and math skills that are so prevalent on the tests. In addition, the students were encouraged to use the software during their free time and after school. Teachers and volunteer college students helped the students understand the strategies as well as the basic skills required in mastering the college entrance exams.

Local information sessions and workshops were held in several areas of the city to encourage both students and parents to become involved in the PREP project. Following the grant year, the PREP project was added to every high school in the Cleveland Public School District. Several other districts have replicated this project.

Traditionally, SAT-coaching software has been thought to be most effective with affluent suburban students with computers in their own homes. The PREP project turned those assumptions around by giving inner-city students access, structure, and support in using test preparation software to improve their competitive standing among college applicants.

CHAPTER 6
COMMUNICATING WITH COMPUTERS

A Telecommunications Project

by Virginia J. Browsh, Donald Hatfield, and James M. Morgan, PhD

Abstract

The Communicating With Computers project was designed to establish telecommunications among students in grades six to eight in 13 elementary and junior high schools. The project grant funded the purchase of communications software, installation of telephone lines, and training workshops for teachers. Modems had been provided earlier by a grant from another source. A series of activities was designed to familiarize students with the computer, booting up the communications software, and logging on and off.

On a typical day, students gathered around the computer and modem. One student was designated to call students at another school. The conversation between the students centered around a common interest such as "What does your school look like?" or "Do you have a pet?" There were no barriers that one might encounter in a face-to-face conversation. Knowing that others were reading their output, students were very concerned about the appearance of their screen displays and their grammar and spelling. The exchanges prompted a great deal of self-motivation in the improvement of writing skills. To save time, students learned to use a word processor to create text files to transmit by modem.

One of the project goals was to improve understanding between students from various backgrounds. The computer opened new vistas; students communicated with students with whom they usually had no contact. Most of the telecommunication took place between affluent students and inner-city students. The process marked the first time that many of the students with these different backgrounds had any sort of contact with each other.

Background Information

The purpose of the Communicating With Computers telecommunications project was to involve one class in each of 13 elementary and junior high schools (sixth through eighth grade) in the Cincinnati Public School District in using computers to communicate with one another. The participating schools were spread throughout the city and served students from a wide variety of backgrounds. The intent of involving the students in communicating via computers was to provide exposure to the two powerful computer applications of word processing and telecommunications, to enhance the language arts curriculum by encouraging students to write, and to work on breaking down established cultural barriers between the student populations.

Goals

The specific goals of the project were:

- to allow students an opportunity to use the microcomputer as a powerful tool for communications and information transmittal and retrieval.
- to improve writing skills.
- to improve social understanding between students from various backgrounds and socioeconomic classes.

The cost of the project was low since schools already owned computers and modems. It was also low cost in terms of efficient use of instructional time, since classroom teachers served as the school's coordinators and closely integrated the telecommunications activities with the rest of the classroom curriculum.

Project Description

Selecting Participating Schools

The right mix of schools and classes had to be found. Principals with staffs who were eager to participate in the project had to be located, and individual teachers to serve as each school's teacher coordinator had to be identified.

The criteria for the selection of participating schools were:

1. At least one Apple IIe microcomputer with 128K of memory that could be dedicated to the telecommunications project.
2. The principal's interest and willingness to support the project.
3. The staff's enthusiasm for incorporating technology in the classroom.
4. The school's socioeconomic and cultural makeup.

The criteria for the selection of the school's coordinating teacher were:

1. Recommendation from the principal.
2. The grade level taught (the project was restricted to sixth grade, with a few fifth graders).

Seven elementary schools and five junior high schools were selected.

Teacher Coordinator Inservice and Training

Teacher coordinators attended five hours of paid inservice training and received pay for two hours of preparation time. Three inservice training sessions were held.

Session One: The modems and telecommunications software were passed out and explained, along with a list of teacher coordinator responsibilities.

Session Two: The word processing program was introduced along with a series of suggestions for language arts activities that could be used to incorporate the modem with the curriculum. Teachers were encouraged to be original in creating their own activities. Teachers were given time to meet with one another to establish calling schedules.

Session Three: Concerns and problems that had been encountered were addressed and evaluation was discussed. The Student Attitude Survey was disseminated.

School Visits and Communication

Telephone and written communication with participating schools was part of the daily routine of administering the project. Each classroom was visited at least twice during the project's duration. In schools where the principal and coordinating teacher were computer literate, it was not necessary to make frequent visits. In schools where computers were relatively new, or teachers were eager to use computers but suffered from "computer phobia," it was necessary to make many visits, offer much encouragement, and give many demonstrations. In some cases, the students had surpassed the teachers in their knowledge of and comfort level with computers.

Vignettes

The following vignettes are included to give the reader a glimpse into the way students and teachers related to telecommunicating via the computer.

The call was made and when the characters started dancing across the screen in a direct salutation to the enrichment class a loud cheer went up from the eight students jammed around the computer in the middle of the school office. Jostling for positions to catch a better glimpse of the green screen, they strained to read the message "This is Blue Jay. Blue Jay coming on loud and clear. Who reads me?" The students caught the military innuendo and 30 minutes later when the engrossed students were peeled away from the computer, an entire squadron had been initiated and top secret military maneuvers were being devised. The students couldn't wait to establish contact with another school and design more military maneuvers for their secret missions.

A sixth-grade teacher often led discussions on teen-age problems, but found that many students were reluctant to participate for fear of revealing their personal problems. She suggested that the class establish a "Dear Abby" forum with sixth graders from another elementary school. The students worked at the computer with the word processor and wrote letters about their real life concerns, using coded signatures, just as if writing to Abby. They sent their letters via the modem and received answers to their questions from the numerous "Abbys" at the other school.

The second graders contacted the "Great Pumpkin" on Halloween. The teacher typed for the students as they helped with sounding out Halloween words like witch, ghost, Wonder Woman, Spider Man, Dracula, Frankenstein, and ghoul. They eagerly helped read the replies in the small script flitting across the screen. The Great Pumpkin reminded them to check their trick-or-treat candy, watch for cars, and wear reflector strips when canvassing their neighborhoods. When the Great Pumpkin finally signed off, she was assured that some 40 second graders would be having a safe and happy Halloween.

A sixth-grade student called a local bulletin board operated out of a nearby university. His eyes grew wide with wonder as he exclaimed, "You mean I'm talking with someone at a *university*?" He sprinted back to the classroom to share his excitement with the other students. A door to a not so distant future had been opened for this young man and the rest of the students in his class.

Rapping is all the rage for several students. One day in the midst of a spontaneous computer communication, a student from another school asked one of our students if he knew how to rap. No more encouragement was needed. Right then and there over the modem lines the following rap was composed, transmitted, and received:

I will type a rap to you
Tell me if you like it.
Well, my name is Rap Sensation
Little Ice for short
I'm not a midnight rocker Shawn or Mort.
If you really think this rap is fresh
You learned it from me, 'cause I'm the best.
'Cause I'm the devastating
Recreated populating
Playboy of the year!

Evaluation

The telecommunications project was evaluated according to the following criteria:

1. A before/after comparison of students scores on the Essential Skills Writing inventory.
2. A before/after comparison of student attitudes using an attitude inventory.
3. Comparison of language arts scores (1986, 1987) on the California Achievement Test.
4. An informal evaluation of hard copies of school transmissions that include a comparison of early transmissions and later transmissions noting file length, content, type, and overall effectiveness in conveying ideas.
5. Project evaluation form filled out by all coordinating teachers.

In addition to this evaluation, the project coordinator visited participating schools and conducted interviews with teachers.

The following observations are based on these school visits and interviews.

1. At the beginning of the project, it took schools a longer time to begin making transmissions than was anticipated in the projected timeline. This problem was solved by the establishment of an electronic bulletin board that allowed transmissions to occur via electronic mail.
2. Teachers with a single computer in their classroom were more successful and active in transmitting than teachers who had to work out of a computer lab. Classroom access allowed students to use the word processor to prepare text files for transmission at any time during their class period, rather than having to wait for an assigned time in the computer lab. These teachers were also able to be more flexible in their transmission schedules because their computer use was not restricted to the computer lab schedule.
3. Students became comfortable with the technology more quickly than teachers. Some teachers were anxious to take part in the project, but were afraid to jump in and use the hardware. The best treatment for this was to have the project coordinator readily available to troubleshoot over the phone and at the school, and to remain positive and patient.
4. Students' lack of keyboarding skills was a major problem. This was especially true during spontaneous communications where one student was typing and a group of students was watching. The onlookers would often become impatient. School districts must prepare students for the technological future by deciding if and when keyboarding will be taught.
5. In classes where students used the word processing program to create files to transmit and where there was a regular transmitting schedule, the length of the writing increased over the duration of the project. One teacher reported that her students' original transmissions were approximately 20 lines in length and are now up to an average of 80 or 90 lines. Also, the variety of types of transmissions increased and students were less inhibited about writing what they felt. By typing messages and reading the responses they received, the students developed a positive attitude toward learning.

Conclusion

We asked teachers what they felt were the most important gains made by their students as a result of using the computer and modem to communicate with other students. Their answers follow:

- Students' self-esteem improved.
- Students became more aware of their communication skills.
- Students seemed to become more accepting of others from different backgrounds.
- There was increased understanding and awareness.
- The project provided experience in working together and assisting each other.
- There was an awareness of different teaching styles, flexibility, patience, awareness of life in other schools.
- Students gained experience in understanding directions and acquiring independence in computer activities.
- Students were able to communicate with peers in other schools and discover common interests.
- Students' thinking and writing skills were enhanced by using the telecommunication system on a regular basis.
- Discipline problems were all but eliminated.

Suggestions for changes were also made by participating teachers.

- Schools that have similar time schedules should be placed together.
- Every school that participates should attend a meeting (workshop) in September.
- Participating schools must agree upon procedures of communicating, set up time, review procedures, ideas of ways to use the program.
- The number of computers and modems should be increased.
- Shared planning between the schools should be emphasized.

The overall response to the project from teachers and students was very positive. The teachers felt that the goals were addressed—students learned about a powerful communications application of computers, they were motivated to write and did write more, and they learned about other students from a variety of backgrounds. Teachers felt that they were well oriented and were able to proceed with a confidence they did not experience during the first exposure.

Project Expansion

The telecommunications project extended beyond the original 13 schools to include every school in the Cincinnati Public School District—at all grade levels—in all disciplines. We believe that communicating through a modem and using a

word processing program for writing will become the norm in this district, a norm that will help students learn, think, and work more effectively and will help break down cultural and prejudicial barriers between students.

In the fall of 1987, the original schools began to expand their use of the modem to communicate with bulletin boards and information retrieval services. There are a wide variety and number of these services available to schools that give students the opportunity to make contact with experts—world wide—and to tie into large databases. In the future, bulletin boards and information retrieval services will be used as easily as the school library for research and communication.

More schools have purchased their own modems and have begun using them for school-to- school transmissions and for information retrieval. To facilitate communications, we established a district electronic bulletin board system at our Educational Technology Resource Center.

In the January-March 1986 issue of *Apple Education News* the editors expressed their views on the future of telecommunications in this way: "Telecommunications is probably the single most important application of computers, because it enables the user to communicate with the world. Telecommunications will probably be the future of microcomputers...."

The Cincinnati Public School District has made a commitment to be a part of this future.

The supplementary materials on the following pages were distributed to participating teachers during the project.

Suggestions for Classroom Language Arts Activities

This is a list of some suggestions for language arts activities that incorporate the use of the modem and computer. The list is not inclusive and you are not required to use any of the activities. You are strongly encouraged to develop exercises and activities that will fit your unique situation and share them with others in the project. Keep in mind that the primary goals of the project are to stimulate students to write, to illustrate to students the use of the computer as a powerful communications tool, and to introduce students to the ideas of persons from a variety of backgrounds and experiences.

1. The first activity usually engages the students in a free form conversation over the wires. Students from one school make contact with students from another school and take turns sending and receiving messages. At this point, very little guidance is suggested. The purpose is for students to become familiar with the computer hardware and software and to become comfortable with using the keyboard to transmit. Save these initial communications on disk and in hard copy to look at later in the year.
2. A logical second activity is to have students exchange written descriptions of themselves, their teachers, their school, their principal, their home, their pet, their house, their neighborhood, and so on. This exchange can continue on a regular basis as a "computer pal" program. At the end of the project, have the "PCs" (computer pals) meet and try to guess who their special friend is. If you have knowledge of and access to a database, have the students enter the descriptive information into the computer for arranging and sorting.
3. Another get-acquainted activity is to have students devise and send an open-ended question form that asks about favorite foods, colors, pets, etc.
4. Encourage students to be observers and reporters by having them exchange school descriptions. Try to determine how the two schools (or classes) are alike and how they are different. Try to get help solving a school problem such as graffiti or littering in the halls by asking for suggestions.
5. Have students write their own riddles or trivia questions and send them to each other on a weekly basis.
6. Play a writing game using the modem. Have students build stories by taking turns entering the text.
7. Have students send holiday greetings and messages or have older students play Santa, elves, Great Pumpkin, Easter Bunny, etc. for a younger class.
8. Have students communicate with famous persons from the past or favorite story book characters.
9. Have students exchange poetry or other creative writing.
10. Have students act as reporters and transmit stories that follow the guidelines of good news reporting—who, what, when, and where. Fit this in with the junior high English curriculum.
11. Have students transmit descriptions of their school surroundings and have the receivers try to guess the school's city location.
12. Set aside one day to have students exchange information about hobbies or extra- curricular activities.
13. Have students write a standard letter and change it according to who will be receiving it. Have the receiving party determine the nature of the person sending the message.
14. Have students critique and correct each other's writing.
15. Have students transmit critiques on movies, books, popular music, plays, or art.
16. Use the activities in MECC *Write Start* for contests between schools or classes.
17. Have students at one school submit a question or opinion or topic for the day to which the receiving students respond.
18. Conduct a spelling bee across the wires.
19. Send writing to specialists at the Education Center for critique or comments.
20. Have students exchange names of their favorite popular music and why they like it.
21. Give students a quotation on which to "free-write." Exchange the writings.
22. Have two schools work together to create an anthology, a newspaper, a year book.

Equity in Technology Project Student Survey

School _____

Race: Black ___ White ___ Other ___

Sex: Boy ___ Girl ___

DIRECTIONS: How do you feel about using computers to send messages to students in other schools? Circle your answer to each of the following statements where:

1 = Strongly Disagree
2 = Disagree
3 = Not Sure
4 = Agree
5 = Strongly Agree

1. Sending messages on the computer helps me to learn about students who are different from me.
   1 2 3 4 5

2. I get a fair chance to use the computer in school.
   1 2 3 4 5

3. The boys in our class get to use the computer more than the girls.
   1 2 3 4 5

4. I like to send messages to other students on the computer.
   1 2 3 4 5

5. Girls like to use the computer more than boys.
   1 2 3 4 5

6. Sending messages on the computer helps me to learn to write better.
   1 2 3 4 5

7. I learn a lot about other students from the messages they send on the computer.
   1 2 3 4 5

8. Writing messages on the computer is harder than writing them with pencil and paper.
   1 2 3 4 5

9. Sending messages to other students on the computer is dumb.
   1 2 3 4 5

10. Girls are better at writing computer messages than boys are.
    1 2 3 4 5

11. Sending messages on the computer helps me learn to read better.
    1 2 3 4 5

Teacher Evaluation Form

Thank you for participating in the Equity in Technology Telecommunications Project. We are interested in your reactions to the project and how you think it helped your students. Please rate the following items on a scale of 1 to 5 where:

1 = Strongly Disagree
2 = Disagree
3 = Not Sure
4 = Agree
5 = Strongly Agree

1. Adequate assistance from the project coordinators was provided.
   1 2 3 4 5

2. The inservice sessions included the information I needed to use computers for telecommunicating.
   1 2 3 4 5

3. The project should be expanded next year to include more schools.
   1 2 3 4 5

4. Students made significant gains in their understanding of computer operations.
   1 2 3 4 5

5. Students' interest in writing increased.
   1 2 3 4 5

6. Students made gains in their writing proficiency.
   1 2 3 4 5

7. Understanding between students from different backgrounds increased.
   1 2 3 4 5

8. I will continue to have my class participate in telecommunicating via computer and modems next year.
   1 2 3 4 5

9. I would be interested in having my class participate in using a district-wide bulletin board system next year.
   1 2 3 4 5

10. My overall rating of the project is:
    1 2 3 4 5

CHAPTER 7

USING THE COMPUTER TO INCREASE ACADEMIC, VOCATIONAL, AND SOCIAL SKILLS OF JUNIOR HIGH OCCUPATIONAL STUDENTS

by Ann Fazzini

Abstract

Occupational Work Adjustment (OWA) students are low academic achievers who spend part of the school day in a supervised work experience. These students generally have very poor self-concepts and are often treated as outcasts by their peers. In this project, seventh- and eighth-grade OWA students attended their English classes in the computer lab. They used word processing for most of their writing projects and instructional software to improve their grammar and writing skills.

The OWA students helped one another on the computer and served as computer assistants to students from other classes who used the lab. Social skills among the OWA students improved throughout the project. The computer environment encouraged sharing and helping, two traits not often associated with poor academic achievers with low self-esteem.

Working within the computer environment marks the first time the OWA students have met with unqualified academic success. Language skills gained in the computer lab carried over to other subjects. Academic subject grades improved for every OWA student involved in the project.

Background Information

The target population was 14 eighth-grade Occupational Work Adjustment students, aged 14 to 15, most of whom were from economically and socially disadvantaged environments and had low academic skill levels and self-images. Although females usually make up about half the OWA class, this group included only three.

One of the females was repeating the eighth grade, two of them were considered moderately serious discipline problems, had a record of detentions and suspensions, and lived in difficult home situations. One of the males was a resident of a group home, having been assigned there by the court as a delinquent.

OWA students need academic and practical skills for self-image and vocational guidance. They are often held in low esteem by others and do not perform well in the conventional classroom. Because of their work schedules, they usually cannot take advantage of special facilities such as the computer lab and are thus denied the academic benefits and social interaction afforded by such facilities. The OWA program is designed to salvage potential drop-outs. We found that the project was successful in increasing student academic performance and social acceptance in comparison to former OWA groups.

Goals

1. To supplement language arts instruction for OWA students through the use of the computer and to build students' logical thinking skills.
2. To teach effective use of word processing and record keeping software.
3. To develop student self-concept through participation as classroom computer aides.

Project Description

OWA students were scheduled into the computer lab for language arts where they followed the regular eighth-grade course of study for both classwork and employment. The students used word processing and other software to complete assignments.

A brief description of activities follows:

1. Keyboarding and word processing skills review: Using *Bank Street Writer II*, students wrote short compositions. Students edited their work using *Bank Street Speller*. Although these students were initially resistant to the editing that is necessary for good composition, they soon realized that the word processor took the drudgery out of revision, and they began taking pride in their improved composition and satisfactory grades.

2. Work assignments: As part of their program, OWA students are assigned work stations around the school. Most of these jobs involve custodial and food service responsibilities. However, some students work as clerical aides for teachers, so they learned to enter scores on grade databases, to enter and print class lists, and to prepare display materials using utilities such as *Print Shop*. In order to emphasize the vocational aspects of their computer expertise, they were able to use the computer lab during their work periods and, if a teacher had a rush job, to use class time with the understanding that they would still meet their class responsibilities. Students became proficient in computer operation, in maintenance procedures such as loading paper and changing ribbons, and word processing. They served as computer mentors to seventh graders who were in the lab for their computer orientation.

3. Special projects: A research report on elements is a science requirement. Using guidelines provided by the science teachers, the students wrote the reports as a language arts project. In consultation with the science teachers, we acquired *Chemistry: The Elements* from COMPress to supplement the library materials available for research. Students learned the technique of setting up a report outline, typing in data, then moving it to the appropriate section of the report. Printing the final report gave them practice in choosing options that would produce a professional appearance for their work. The science teachers reported that the language arts aspects of the papers such as spelling, grammar, and form were well done and much better than they would have expected from OWA students. Moreover, the students themselves commented that the reports were better organized and looked better than any they'd ever done before. In fact, one student told me it was the best report he'd ever done because it was the first one he'd ever bothered to do!

4. Computer assisted design: *The Toy Shop* by Broderbund was used as an introduction to the concept of computer assisted design, fulfilling our vocational goal since OWA students are often interested in mechanical things. Students chose models, mastered the customizing, data file, and printing procedures of the program, and followed the direction manual for assembly of the models. The associated language arts activity was to write a story about the model. One student who had been resistant to the academic work up to this time proved to be a very proficient model maker and became a mentor for students who were not so adept. His model, a catapult that propelled spit wads with astounding accuracy, was probably the most successful one completed by the OWA students, and the story he wrote about it showed ability that had not been evident before.

5. Writing business letters: The students used stationery that they designed with *Print Shop* to write letters of inquiry for information to use in their research for the career report that would be assigned by the OWA teacher for their careers class during the fourth quarter.

6. Punctuation skills: The punctuation exercises were on a *Bank Street Writer* data disk. Students transferred them to their own data disks, completed and corrected them at their own rate during several weeks allotted to this unit, and the complete, corrected printouts were placed in their class folders to be used as references for punctuation problems in their own compositions.

7. Book report for social studies: A social studies book report was assigned to deal with issues related to these students. Students read biographies of successful people who had overcome handicaps such as poverty, unstable homes, and learning problems. The assignment guidelines directed them to discuss the handicaps overcome by the subjects of the books and compare them with similar circumstances in their own experience. The objectives of the assignment were to increase reading and reporting skills and to provide personal guidance.

8. Career research report: The career research report was a joint project for language arts and the OWA careers class. Students used *Careers 2000* from Career Aids, Inc. and materials sent in reply to the letters they had written earlier. *Bank Street Writer III* from Scholastic, which uses an 80-column screen and has a built-in speller and thesaurus, was used as the word processing program.

9. Creative writing: This assignment met with some resistance because these students are generally not very articulate and feel insecure if there are no definite questions to answer or rules to follow. However, one of the students worked on several short stories, one of which she entered in a local contest for junior high writers. Her story, "Missy," won Honorable Mention, a real triumph as she was competing against students who had been in gifted and talented and young writers programs for several years.

10. Research and social studies skills: Using *Where in the World/USA Is Carmen Sandiego?* by Broderbund and *Cross Country USA* by Didatech, Software, Ltd., small groups used the computer lab and the OWA classroom computer during the OWA guidance class period. Worksheets were provided to supplement the maps and other references available for these programs.

11. Other activities: Students worked on programming lo-res animated graphics in BASIC and printing them out using *Low Resolution Graphic Plotter* from Burke Software and the multicolor ImageWriter II ribbons. The lo-res graphics were a joint project of the math and computer literacy classes. Several seventh-grade girls who were particularly interested in computers volunteered to print the best graphics and eventually produced a Stewart Math Hackers bulletin board display that elicited a great deal of student and faculty interest. Another group completed a bulletin board for Black History Month. Using a combination of *Print Shop* graphics and pictures duplicated from reference books, they produced

an elegant black and white display that a number of faculty members said was the best bulletin board they'd ever seen. Students used *Certificate Maker* from Springboard and *Grid Designer* from Power Up! to produce forms for staff members, for their own class projects, and for extracurricular organizations.

Evaluation

On the whole we feel that the project has been successful. Our evaluation is based on comparison of the group's language arts grades with those they achieved during the year prior to the project year, comparison of behavior and attendance records with those of previous OWA groups, comments from other subject matter and supervisory teachers, and observation of relationships between OWA students and other students and teachers.

Goal 1: To supplement language arts instruction for OWA students through the use of the computer and to build student logical thinking skills.

The computer supplemented OWA instruction in language arts class and in assignments in other classes requiring language arts skills. A comparison of grades shows 74 as a language arts final group average for the previous year, 86.5 as a group average for first semester of the project year, and 83.3 as a final group average. No students received a lower final grade than they had achieved the preceding year, all but two raised their final grades including two students who had failed language arts the preceding year, and one student went from a D- to a B.

Teachers in other areas such as science and social studies reported that written assignments exhibited better spelling, grammar, and organization than they would have expected from OWA students. Moreover, the number of completed assignments was higher than in previous years.

As the students worked on reports, their thinking skills improved in that they became more adept at evaluating information and organizing it logically. We were, however, disappointed in their ability to make comparisons and draw conclusions from their reading, particularly in social studies. This may have been due to their generally low reading level and the fact that books written at that level tend to present information very simply and, in the case of biographies, to eliminate controversial information that can form a basis for a good discussion.

Goal 2: To teach effective use of word processing and record keeping software.

The improvement in students' grades is almost certainly a result of learning to use the word processor and having a computer readily available for classwork. OWA students typically have poor handwriting, spelling, grammar, and punctuations skills, and these deficiencies become a barrier to communication. The ease of editing that is the "miracle" of word processing encouraged these students to stick with assignments that they might otherwise have abandoned.

We did not make as much use of database software as we had planned, although three of the students did work as teacher aides, entering grades and other data on the computer. As the faculty becomes more computer oriented, we anticipate that there will be increased opportunities for students to work with databases, particularly for classroom and activities inventories.

Goal 3: To develop student self-concept through participation as classroom computer aides.

In the past, OWA students have generally been held in low esteem by faculty and other students and have gained status through negative means such as disruptive behavior. They have not had much positive interaction with students outside the OWA group and have, indeed, been viewed by them with attitudes ranging from contempt to outright fear.

As a result of having become proficient computer operators, OWA students were viewed as mentors by other students and by teachers who often asked them for help when the teacher was unavailable. Furthermore, they often volunteered their help, a real departure from typical OWA behavior. Substitute teachers, who had often dreaded working with OWA students, commented that they were helpful.

At the end of the year, a number of the OWA students expressed the hope that they would be able to continue working with computers next year, and one girl applied for a summer program for disadvantaged students that she hoped would include some further computer training.

> Emily asked that her contest story be sent to the high school as an example of her work and talked with me about continuing to write short stories and possibly submitting them for publication.
>
> Allan won the Margaret Witt Award, our school's highest honor that is awarded each year to an eighth-grade girl and boy for service to the school. The recipients are chosen by the faculty, and Allan's nomination was based largely on his work as a computer aide. The fact that he had been a resident of a group home during the year made this achievement even more significant. He is now back with his mother and says he hopes he can work with computers at the school he will attend next year.
>
> One of the girl's fathers investigated summer computer opportunities for her at Miami University, and the parents of another bought a home computer largely on the strength of Julie's interest.

Replication

The project was viewed as an experiment to determine the impact of computer technology on student performance, particularly with low-achieving students. The faculty felt that the project was successful and the kinds of activities it included should be further expanded since the technology seemed to minimize the communication handicaps of students and allow them to interact with other students on a more equal basis than formerly. Following the pilot year, the project activities were incorporated into the total curriculum and are being used by many of the teachers, particularly in language arts. The program moved to a new facility with a faculty committed to the use of computers as a medium of instruction.

Although we planned to continue scheduling the OWA students into the computer lab for language arts, it was decided to return them to regular classrooms since the eighth-grade language arts program became a writing lab with all students using word processing. The OWA classroom has a computer that students use for social studies, reading practice, and supplementary work. The OWA teacher schedules them into the lab for special projects such as career data searches. In addition, two of the OWA students are assigned to the computer lab one period each day to act as aides.

Of the seven females in the OWA program, at least two use the computer in their capacity as teacher aides and two others are frequently assigned by the language arts teacher to accompany other students to the computer lab to act as word processing tutors.

Conclusions

We believe that the project has helped improve performance and attitudes in both OWA students and students in the general population. The quantity and quality of eighth grade writing has increased with the use of word processing, and OWA students are now scheduled into regular classes with no problems. In their work assignments, OWA students regularly act as computer aides for teachers.

There seems to be a difference in attitude toward OWA students. Since they have a great deal of computer access, they are proficient in both application and operations, and their willingness to assist other students has helped establish positive social attitudes between them and non-OWA students and between them and staff members.

Students and teachers alike are now using computers for such a variety of activities that we are discontinuing our computer literacy short courses and will use the computer lab totally as a resource room with students coming individually and in small groups to work on class assignments and projects. We are studying the new technology such as interactive videodisc so that we can continue to expand opportunities for our students to learn in the way that they will eventually live and work—with computers.

Additional Suggestions

The computer can be a powerful tool for bringing disaffected students, especially those from socially and economically handicapped backgrounds, closer to the mainstream. Because they often lack the nurturing and examples available to most students, they may not develop the communication skills upon which academic success depends. By the intermediate and junior high years, these students have often given up on education and are seeking social position through resistance to a system that they can't master. Students gain status through their proficiency in computers. Disaffected students achieve a sense of worth, particularly if much of the work is simulated vocational activity rather than obviously remedial or drill and practice. As they master the various procedures, they are likely to see themselves in the technical/professional roles they see depicted in the media.

Word processing overcomes the poor handwriting and minimizes the spelling problems that can be so discouraging to these students that they often refuse to write at all. When they see that their compositions and reports are as attractive and readable as those of "good students," they are more willing to do the editing that is necessary to improve writing. Since the word processor makes this editing so easy, their final products will be far superior to those of similar students without access to the computers; however, it must always be kept in mind that these students are very volatile and a few good compositions will not set them forever on the road to success. Because their lives are often disordered and because they themselves may lack the ambition or capacity to strive, it is necessary for the teacher to look for activities that will intrigue the students and offer manageable challenges. These students are not articulate, so the teacher must encourage and help them to explain, to expand, and to describe. Above all, the teacher has to be patient because these students are distrustful and insecure and will particularly test the sincerity of an adult who shows interest in them.

Conventional language arts assignments may not be suitable for these students because they do not lead conventional lives. Keeping in mind that the primary purpose of language arts is development of communication skills, the teacher should look for projects that involve language skills and also have vocational implications. For example, other staff members may be willing to have students act as secretaries, entering and maintaining equipment inventories, typing and printing schedules and memos, and preparing handouts and display materials. Ironically, even though these students resist conventional assignments, if their work is too different from that of other students, they may decide they are being set apart because they aren't capable. One method of handling this situation is to give students a choice of projects the teacher has organized so that, over the year, they will have dealt with all the requirements of the course of study. When students feel they have some choice in their work, they are more likely to cooperate.

Working with disadvantaged students can be extremely frustrating because their hostility and lack of social skills prevents them from sending the little signals that more adept students use to reward teachers. If you are successful in working with them, your colleagues who have trouble with the same students will assume that your standards are too low or that you are being duped.

At times, it may seem that the only advantage of the position is the job security resulting from the fact that no one else wants these students. However, the work is never dull because you can never relax and, once in a great while, you will receive the tremendous boost of hearing a student mumble, "Well, this ain't too bad." Correct the grammar, give the student and yourself a brief pat on the back, and plod on!

Example of Student Writing

These two compositions were produced by the same student. The first was the first project assignment and the second was the story to accompany the *Toy Shop* project. The instructions were similar except that the *Toy Shop* story was to include dialogue. By the time the *Toy Shop* composition was completed, students had become proficient in word processing and were accustomed to editing so that the compositions contained very few errors. Although I helped with editing, they used the spell checker feature of the word processor and also acted as editors for each other.

9/5/86

MY SUMMER

This summer I did a lot of different things, for example i got a new bike. And i worked at Candelwood apartment complex and made all kinds of money. For example I bought a new pair of shoes,and this Friday I'm going to by a new radio. I can't wait to get it. It is the biggest radio I've ever seen. All so I went to visit my aunt ,she is a fun person to go see. She gives me cake and cookies.But the best part is when we leave she gives me a twenty dollar bill.I have It spent before I evan get It .when we get back I go right to the store and spend It. And I also go out to my friend house,and we go out to is barn get is three wheeler and go out into the woods. We make trails every where go. But sometimes the three wheeler get stuck in the mud, and we have to get off and try to push it out. Its a pain sometimes to get It out. But they get us where we want to go.

11/26/86

TOYS

My story is about a little boy who lives in the North Pole a few miles from Santa Claus. He always likes Christmas because Santa always makes him a special toy and always likes what he bring him. Santa is real special to him. He always waits for him on Christmas eve to try to see him and meet him. But he's always drifts to sleep before he comes and he's gets real disappointed, but when he sees his special toy, he gets real happy again. The next day he opens his gift. He finds it's a helicraft. He thinks it's the best gift that Santa has ever brought him.

After a few days of building his toy, he is almost ready to try it out. He has to color it in and put a good rubber band in, and he takes it out for his test flight and finds it isn't doing just right, so he takes it back in and takes it, apart to see what's wrong with it but he can't see what's wrong. So he takes it to Santa's workshop to try to get it fixed. And he runs into an elf.

The elf says, "May I help you?'

Then the boy says,"Yes, I need see Santa."

The elf says, "What do you need with Santa? He's a busy man."

The boy says, "The toy Santa brought me I can't get to work".

The elf says, "Wait a minute and I'll get him."

The boy waites and before his eyes he sees him for the very first time.

He goes up to him and says,"I'm having a little problem with my toy and I wonder if you could help me.

Santa says,"Sure. What seems to be the problem with it?"

The boy says,"It just doesn't fly right." Santa takes a look at it,

"Aha! I see the problem. It's your rubber band. It's too small."

He gives the boy a bigger rubber band, then they put it back together and the boy thank him and he goes home and tries it out and it works perfectly. He tells his mom and dad plus all his friends that he goes to Santa's work and he helps him put his toy together.

Everybody is amazed.

Section Three

Equity for Students with Disabilities

CHAPTER 8
EQUITY FOR STUDENTS WITH DISABILITIES

An Overview

By Alice Fredman

In *Personal Computers and the Disabled, Apple Computer Resources in Special Education and Rehabilitation*, personal computers are called "amplifiers of human ability." (Office of Special Education Programs. Apple Computers, 1989)

One of the project leaders in the Equity in Technology Project said that her project "did not improve the vocabulary inside her students' heads—it released it."

For students with physical and developmental handicaps, using the computer unlocks their potential. It is an enabling tool—allowing them to function as other students function without the barriers that their handicaps impose.

Leaders in the ECCO projects that dealt with equity issues related to children with physical disabilities found that the key word was *access*. For some students, access meant simply being able to get to the computer lab, and once there being able to maneuver a wheelchair around the computers and tables. For others with limited motor skills, access meant having an adaptive keyboard. For visually impaired students, access involved using software with a speech synthesizer. To all students with physical handicaps, computers were an equalizer, enabling them to participate in all aspects of school work.

Our project leaders found that computers held enormous potential for deaf and hearing impaired students. With personal computers, these students were able to compete on a more equal footing with the hearing community. Computers bridged the communications gap that existed between them and other students and instructors. Word processing programs and telecommunications software were among the most helpful types of computer applications for hearing impaired students.

Computers broke down barriers for blind and visually impaired students. Talking programs, speech synthesizers, and Braille printers put these students on a more equal footing with their peers.

Students with even very limited muscular control were able to use the computer with the help of an adaptive keyboard or switch. We learned that even if the only controllable muscle is the eyeblink, these students can still control a computer to use a word processing program, opening lines of communication formerly closed to them. An adaptive firmware card allowed users with physical disabilities to run off-the-shelf software using a variety of special input methods.

Computers were equally valuable tools for students with developmental or behavioral handicaps. Here the key issue was *communication*. All too often, these students seemed locked in their own world, unable or unwilling to communicate with others. The computer unlocked their potential for language and resulted in improvements not only in language skills, but in other academic areas and in an enhanced self-image as well. Budoff et al. (1985) in *Microcomputers in Special Education* states that thecomputer enables the poor or inefficient learner to minimize or circumvent significant barriers to learning. Students who are able to understand basic math concepts but unable to do error-free calculations (due to poor memory, visual, perceptual, or other problems) can manipulate numbers and letters with greater ease and accuracy in an interactive mode. Their reasoning abilities can be expressed without interference from their problems in producing output. Using the computer as a word processor may help a special education student bypass writing, spelling, and language arts problems by allowing the student to edit and revise work easily. The time and energy formerly spent on laborious rewriting of rough drafts can be spent

developing ideas in a legible and acceptable form. The ready availability of spelling or punctuation-checking programs can pit the child against himself. The computer motivates him to reduce spelling or other writing errors, since he can chart his errors after each attempt to reduce them. Most important, the child unable to produce acceptable work can demonstrate his productivity to himself and others.

In the ECCO projects, students with learning disabilities used a word processing program with a spell checker that enabled them to complete writing projects of which they were proud. Many students with learning disabilities had difficulty with paper and pencil tasks. With a computer and word processing software, many of the arduous tasks of organizing thoughts, writing, recopying, and reworking were eliminated. Writing process software and desktop publishing programs made it possible for them to share their writing with fellow students, parents, and others in the school community.

We found that instructional software, particularly those programs that could be adjusted to the students' own pace and that included a good management component, were excellent teaching tools. The computer, a nonjudgmental, endlessly patient tutor, was programmed to adapt to all the students' needs and limitations. Children with learning disabilities benefitted by the repetition of material. Drill and practice software was beneficial. Individualization of instruction, too, was enhanced by the computer. Individual education plans and computer based lessons were prepared to meet individual needs. Students worked in small, sequential steps until a skill or lesson was mastered. Students with behavioral problems were motivated by the computer. Their feelings of self-worth were enhanced and frequently their behavior dramatically improved.

In the following chapters, two Equity in Technology Projects that deal with communication skills are described. **Computer Usage by Children With Learning Disabilities: An Exploration With First- and Second-Grade Students**, concerns itself with young students with learning disabilities, while **The Write Way** deals with students who are orthopedically handicapped. Even though these two populations are quite different, the need for communication skills is a common theme in many of the projects that deal with students with handicaps. A third project, **Hands-On**, describes the use of peer tutors in a high school learning disabilities lab. In this project, improved learning and enhanced self-image were project goals.

CHAPTER 9

COMPUTER USAGE BY CHILDREN WITH LEARNING DISABILITIES: AN EXPLORATION WITH FIRST- AND SECOND-GRADE STUDENTS

by Lois de la Pena

Abstract

Computer Usage by Children With Learning Disabilities: An Exploration explores the potential of a computer equipped with appropriate software to help first- and second-grade children with learning disabilities perform at or closer to intellectual potential in several areas. The project targets three areas: written expression, organization of information, and a less well delineated group of individual problems that respond best to multi-sensory stimulation.

Most children with learning disabilities have problems with written expression, and many are unwilling to put forth much effort because of their problems. Difficulties may be the result of problems with fine motor coordination, sense of spatial relations, sense of direction, visual memory, visual perception, and organization. Using a word processor provided these students with a tool that wrote legibly and organized their words on paper. Transposed letters and omissions were easily corrected. Spelling checkers focused attention on errors so that they could be corrected. Children with visual perceptual problems perceived their errors on the monitor better than they did on their own handwritten papers. A "talking" word processor's speech synthesizer added even more feedback through oral stimulation. All the students wrote more and wrote with far more enthusiasm when they used word processing.

Students with learning disabilities often have problems with sequencing and classifying information in subject matter areas. A database and spreadsheet were used to assist the students in organizing information. The use of this software allowed the students to view their school obligations on a daily basis—one task to remember instead of three or four. The computer, with adaptive hardware and specially chosen software, was also used to meet the very special needs of some students in the class.

Background Information

Purpose of the Project

Though handicapped in one or more basic skills, children with learning disabilities possess at least average intelligence and are expected to pursue the regular school curriculum. This project was designed to explore the potential of a computer equipped with appropriate software to help these children perform at or closer to intellectual potential in several areas. Children with learning disabilities commonly exhibit one or more of the following needs: the need to improve their abilities to express themselves in writing, the need to be taught strategies for organizing information and their obligations, the need for more drill and practice than others in order to learn basic skills.

Insofar as they are known, students' needs are documented through individual standardized testing and teacher referrals when they are placed in the class. This placement is reviewed by a team of professionals every three years. The very particular needs of the project participants during the 1986-87 school year were included in the Target Population Profile.

Target Population Profile

During the 1986-87 school year, 10 students with learning disabilities were involved in the Equity in Technology Project. Five students were assigned to the class for at least one half of their school day throughout the year, four were thus assigned during at least six months of the school year, and one student received instruction for one-half hour per day during a three-month period.

All students were second or third graders, and ranged in age from eight years, three months, to nine years old when the project began in September. The five boys and one girl in second grade had repeated or were repeating a grade. The two boys and two girls in the third grade were age and grade appropriate.

Ethnic and economic backgrounds varied. Eight students were black, two were Caucasian. Two were upper middle class, four came from homes that were apparently financially strained. Two children lacked telephones. In some cases, these young children and younger siblings seemed minimally supervised because parental work schedules permitted them neither time nor energy for child care. Between these two extremes were four apparently middle class families. These parents seemed better able to respond to the their children's needs, in spite of the fact that both parents worked outside the home.

Seven children in the group gave fairly frequent indications of being hungry and/or very tired in school. One child reported several times a week that he'd not had breakfast, others more sporadically. Several children's lunches seemed very deficient nutritionally. Some days, some children seemed too tired to learn. They complained of being tired or ill, rested their heads on the tables, seemed irritable, and even fell asleep in class. It became apparent that they had watched television programs that ended at eleven or twelve o'clock. One child reported that he went to bed when he pleased and got himself up to go to school while his mother slept. This child had a great deal of difficulty with self-control and sometimes lost whole mornings because of inability to focus on his school work. By spring term, he and another child were missing approximately 20% of class time because of lateness.

Children are placed in a special class for the learning disabled when there is significant difference between academic achievement in any one of seven areas and intellectual potential (as measured by intelligence quotient). The seven areas tested for placement are basic reading skills (word recognition), reading comprehension, mathematics calculation, mathematics reasoning, written expression, oral expression, and listening comprehension. If a child's standard score in any of these areas falls two standard deviations or 30 points below his I.Q. score and he meets other exclusionary criteria, he/she is eligible for services. A placement team can also agree to offer services when it feels that evidence of a learning disability is very strong in spite of a somewhat more moderate discrepancy. Each child in the target group qualified for special services because of discrepancies in two or more areas of achievement. Intelligence Quotients as measured by the Wechsler Intelligence Scale for Children, Revised, ranged from 69 (mentally deficient) to 125 (superior).

The incidence of behavior difficulties in this group was unusually high. Four of the second-grade boys constituted the majority and focal point of a kind of gang including a few other students in that grade. Gang members seemed to value tough behavior and peer or gang approval over that of adults in school. The group was easily identified as the severest behavior problems in the school. Two other children posed behavior problems individual to themselves. The resultant loss of time for constructive work was extremely costly to all these children.

Goals

1. Students will demonstrate proficiency in word processing, using a database and spreadsheet, and in using the computer to assist their own learning in areas of weakness.
2. Students who participate in the project will demonstrate greater improvement in those skills targeted for computer assistance than learning disabled students generally show after a similar period of placement in a special class without a computer.
3. Students will show sufficient improvement in targeted basic skill to demonstrate the need for computers in all classrooms for learning disabled students.

Project Description

After the initial one-week testing period, class convened. Seven to nine children spent the entire morning in the class. It served as their language arts instruction (reading, spelling, handwriting, language). Five of these children whose learning disabilities also affected their math performance returned to study that skill in the afternoon. The 10th student in this study did not join either of these groups, but came later in the afternoon starting in March.

The language activities and time periods fell into four major categories: introduction to computer usage, keyboarding, word processing, and reading instruction. The computer was also used for drill and practice in math, and was used more by some students than by others to meet individual needs.

Introduction to Computer Usage

We began with *Magic Slate*, *Bank Street Writer*, *Moptown Parade*, *Math Blaster*, *Tink's Adventure*, and *MicroQuest*. Two lessons were prepared, offering most of the group at least one computer activity. Four of the second graders could not remember how to read the words for numerals, so a simple multiple choice matching activity was set up for them using *MicroQuest*. A list of 50 words commonly used in computer programs was compiled, and each student's ability to read those words was tested. The beginners were given keyboard diagrams and worked in groups of two or three at matching flash cards (return, delete, caps lock, the arrows, space bar) with the locations on their diagrams. The list was kept short and selected for maximum early use on the computer since reading skills were very limited. When students could locate, if not read, the return key, the caps lock, and the space bar, they began to use the computer itself with *Bank Street Writer*.

Routinely, children in the class were required to copy their weekly spelling words on Monday mornings and to list them again in alphabetical order on Wednesday. Starting in October, the 20-column version of *Magic Slate* was used for these spelling lists by as many students as possible. At first, two students at the most managed to complete their lists in periods of more than one hour. Surprisingly enough, they were willing to work this long for the privilege of watching the printer print out *their* work.

We next used the *Compukeys Program*. All students participated in the introductory lesson in small groups. The lesson devoted some time to seating, and orientation to the computer keyboard, and good computer posture. Interestingly enough, these children tended to ignore any teacher's request or demands for similar standards during lessons, but were very impressed with the computer's instructions, remembered them, and reminded each other when they worked in pairs.

Tink's Adventure combined an animated story with practicing either alphabetical order or the arrangement of letters on the computer keyboard. *Moptown Parade* compared geometric figures for likenesses and differences, really a pre-reading skill. Each of these required a certain amount of reading vocabulary that all the second graders and one third grader lacked. Time to teach enough vocabulary (not generally transferable to other programs) to make the students independent with these programs would have been prohibitive, but they did offer some very simple games, animation, and, in general, a little spice for the program.

One student appeared to be angry most of the time. He confronted adults with his chin thrust forward, and if he could, peppered lessons with sarcastic remarks. He seemed to be an attitudinal catalyst and leader for the gang mentioned earlier, and the others seemed to need his permission or approval to cooperate or like an activity. After a few sessions of help by the teacher, he was using *Tink's Adventure* with minimal help though he could not really read the story. We noticed that his usually thrust-out chin was back in the right place when he was at the computer.

In late October, the beginning word processing activities were expanded from the 10- or 15-word lists of spelling words to writing sentences under supervision, and finally to trying to write final copies in creative writing. *Magic Slate* in the 40-column version was used for this activity.

By this time the students had been shown a book of stories written and word processed by the previous class. They were accustomed to sitting as a kind of editorial board on Friday mornings to share stories they had written during the week, to suggest improvements, and to decide whether or not they were some of each author's best work and thus worthy of being included in *the* book for the current year. Though most students' stories were very brief at this time, few children were up to the task of typing them on the computer.

We noticed a correlation between success at these early computer activities and the students' reading ability.

Keyboarding

The class began to learn keyboarding with the Ataris. It was soon apparent that even the four home keys for one hand were too difficult for one lesson. All the children experienced great difficulty in controlling and moving any fingers independently, except for the index finger. In order to practice the skill of independent movement, the keyboards were temporarily abandoned and colored stickers were placed on the table top. Children practiced striking the stickers with their fingers.

We changed to the Apple computers and each child was put through the *Compukeys* introductory lesson. They were asked to use correct fingering on the home keys and could not. The Apple keyboard differs from the old Ataris in that the keys actually go down. This was either harder or just different, but everyone had difficulty. One student became so frustrated that she began to cry.

Efforts to solve these problems included having an adult sit behind the student, place his hands over they child's and say and depress the keys with her/him. Since some children were uncomfortable when they could not see the keys, stickers identifying the letters were placed on their fingernails. Finally, the home keys were drilled verbally until each child could name them in order, though this did not help them press one key at a time.

Two other typing programs, *MasterType* and the typing section of the *Talking Writer*, were tried briefly at this time. The best features of these programs were games on which some children achieved miraculous scores, but they did so in every case by ignoring proper fingering. It is possible that more mature students would have the self-discipline to use the games correctly. *Compukeys* also offers games that can be played at the completion of each lesson. All the students enjoyed these. and, since they involved typing a line of print, they were used correctly.

Reading

Two programs dealing directly with reading skills had been ordered for the project. These were *Reader Rabbit* and *Paint with Words*. *Paint with Words* was useful to all the children in some way. The target skill for this program is recognizing words at sight, and it contains a vocabulary of 124 nouns, most of which are pictured. Children may select any one of nine backgrounds for pictures that are painted by moving words designating appropriate persons or things onto the background. The student can change each word to its pictorial representation when he or she feels it is properly placed on the background. Children were introduced to this program in small groups, but all were able to use it independently. Any words a child could not read could be materialized as a picture on the screen. Enthusiasm for this program ran very high.

This piece of software seemed ideally suited to the beginning reading needs of children with learning disabilities. It provided the endless repetition in a very entertaining way, and constant association between word and picture. The printed pictures provided a valuable intermediate step between the learning experience and ultimately reading the words without any cues. The program could be used independently by all the students after a minimal introduction, and before year's end, all the children had learned by themselves how to print their own pictures. Materials so universally useful to children with learning disabilities are rare.

Word Processing

Word processing experiences, the spelling lists, and the initial attempts at writing stories occurred early in the year, but word processing as a major focus did not begin until March. Only two children had reached the keyboarding goals, but the class had been planning the book of stories for the entire year. Putting those stories into final form could not be further delayed

The voice synthesizer had been introduced in January. *Talking Text Writer* was set up to make the computer "speak" to the children. To further this illusion, the screen was darkened and one of the students was cued to command the computer to speak while the rest of the class was seated at some distance from it. It announced that it was lonely in the corner and called the children to it by name. The children enjoyed the experience and the class discussed the benefits of using a talking word processor.

A wall chart, which cued the most basic commands with as many pictures as possible, was developed and hung over the computer. Several lessons were given in small groups to help the children use the chart and program.

Students used the various capabilities of the synthesizer to assist them with their work. One student followed all the teacher's suggestions—that he listen to his work being read as he wrote it, then listen to it by lines, and finally by entire screens. It helped him enormously to overcome a tendency to omit words and suffixes. It mispronounced some of the words he misspelled, but phonetically correct misspellings were accurately spoken.

Three students who were less able readers, typists, and computer operators, were, nonetheless, assisted by the synthesizer. One student who was a bit less meticulous and lacked the patience to listen by lines, listened with pleasure to his whole story. He then summoned help to correct the errors he could recall. Two students were amused by the phonetic speech of the synthesizer when it mispronounced and sought help to correct it. Their reading abilities were so limited that even the synthesizer didn't help them much with proofing for omissions, spelling, capitalization, or punctuation, but the synthesizer did help them. Two students who were relatively capable readers, did their work slowly and steadily without much indication that the synthesizer was helpful.

Quite plainly, the word processing experience in the Spring was more positive for the children than it had been in its introductory phases in the Fall. In spite of the fact that most children had experienced limited formal success with keyboarding, they had all gained greater familiarity with the keyboard and were more competent typists.

Once stories were completed, several other steps led to the final publication of the book. A copy of each printed story was made and placed on the illustration board. This was a bulletin board that contained an envelope for each child's work and oak tag frames that were clipped to the pages to keep drawings out of the margins. Special black markers were available. Children could work on illustrating when they wished, as long as their daily routine work was up-to-date. For most who loved doing the illustrations, this provided real incentive to keep up with their work.

A deadline, May 15, was established for all contributions to the book, and the final steps prior to printing were accomplished during the next week. The last editorial board meeting was devoted to choosing a title and illustrations from *Print Shop* for the book cover. This was a difficult meeting with many diverse opinions, but *Super Stories* was finally chosen for its double meaning, super work and practically super humans. The group then divided over the "Pen and Paper" and the "Universe" for the cover. The high feeling generated by these decisions and the difficulties inherent in discussion for these children made this meeting a near disaster. For example, when the project leader finally suggested that both pictures could be used, one for the cover and one for the title page, even the children who preferred the Universe became angry because they didn't understand that their preference was being followed. It took some time to straighten it out to the satisfaction of everybody.

During the next week the book was assembled by the project leader with the stories arranged chronologically by the writing date. A certain amount of cutting and pasting was necessary to make maximum use of each page, a priority of the school district. By May 22 the dummy book went to the central office for printing.

The books came back one week later, and the children's reactions were almost indescribable. They arrived on May 28, just preceding the last day for the student teacher and her leave-taking ceremonies, which were complete with refreshments. At the conclusion of the student teacher's party, the children were asked to wash their hands for a special surprise. The books were handed out to the children about 10 minutes before recess. When recess time was announced, they were still sitting in their circle looking at and talking about the books, and no one seemed to hear or move. Finally, as previously arranged by the project leader, the entire group of nine authors went to the office to present a copy of the book to the principal. One student was appointed by the teacher to physically hand the book to the principal (which he did most proudly, but wordlessly), because he had made the most progress with creative writing, keyboarding, and word processing. Since five of the nine children had seen the principal about their behavior problems approximately once a week during most of the school year, this was a uniquely proud occasion for them.

The impact of the book was felt throughout that school day. In a sense, one had to have experienced the year with these children to understand how they valued it.

In the possibly five minutes between dismissal from the special class and lunch time, all seven teachers in the second- and third-grade wing were shown the book. They spoke of the excitement and pride of the children.

Innumerable times during the day, children were seen showing the book to teachers in the halls with comments like, "See, I wrote this," or "That's my name, right there." It must be understood that these children really avoided teachers as much as possible. It is common for young children to seek attention in the form of conversation with teachers, but this group avoided even the basic amenities as a part of the gang code.

According to other teachers in other wings, the children also took the books onto the playground and showed them to other children during afternoon recess. The fourth grade teachers, who had nothing to do with these children, were well aware of the book by 3:00 p.m. Perhaps the final evidence of the high value placed on the book was the fact that each child remembered to take it home at the end of the

day. The project leader stood in the hall as the children left, and each child in passing commented that his/her book was in the school bag or held it up, saying they were afraid it would get damaged in their book bags. Getting children to take things home, even prizes and special art projects, had been a problem all year. Never had every child in the class simultaneously remembered such a task during the entire year.

For the teacher, to whom the project had seemed woefully short of its original intentions, the reception of the book by its authors made the entire project seem worthwhile. That the most significant event in the school year for these children—and the book clearly topped everything—should have been evidence of academic achievement in an area of weakness for all of them was mind boggling.

Print Shop

Never a major focal point, *Print Shop* was introduced in late March to add some diversion and fun to the program. Small group lessons introduced the children to the picture, print, and layout options provided by the program, and each child was helped to make a full page sign or a greeting card in order to learn to use the program. Most of the boys chose to copy a "keep out" sign with a skull and cross bones that was shown on the program's box cover.

By Mother's Day, most children were proficient enough to use the program independently. Colored paper had been purchased for these cards, and samples of the ways each ribbon color printed on them were prepared. Though the quality derived from putting ribbon color on colored paper was fine in most cases, no one chose to use colored paper. It was interesting and probably typical of many children with learning disabilities that they failed to make the associations between the available graphics and the holidays or occasions for which they were more or less intended. Many hearts were associated with Easter, students in cap and gown with Mother's Day, etc. These unique Mother's Day cards were taken home along with baby spider plants that the children had rooted and potted.

Print Shop seemed to add enjoyment to the program and was most useful in making the cover and title pages for the book. It was a well-adapted program for this group because the verbal material was limited and the formats prescribed. One could not get hopelessly lost in it. Enthusiasm for it ran very high among all the children. It had great value if only for this reason.

Organizing Information

Each child used the computer for data storage and organization. The spreadsheets developed during the summer were used from the second week of class in September until the last week of school to keep track of the points that each child earned in the behavior management program. Each child was able to earn three basic points per day for staying on task and achieving his two individual goals. The day was divided into time periods of approximately 45 minutes. One could earn a credit or a zero in each area for each period. These were averaged by the computer to the nearest tenth of a point. Children could also earn bonus points for handing in homework on time or even one day late, for good grades in tests, and for various special academic and behavioral achievements. The spreadsheets averaged the basic three categories, added the bonuses, subtracted the fines (for late work, abuse of the room or materials), and kept a daily cumulative record for each student. At the end of the week, the spreadsheet, annotated with explanations of bonuses, fines, and missing homework, was printed and sent home as a part of each student's packet. The points earned were converted twice annually to "bucks" which could be spent at the class auction.

In addition to the spreadsheet, the packet contained seat work completed that week, a brief report on achievement and behavior when the latter was relevant, and a form note which parents returned to the teacher to let her know that the packet had been received. Since the positive aspects of the spreadsheets were highlighted in green and the negative in orange, the children came to hope for "green packets."

The children were also shown the teacher's gradebook, which they understood in varying degrees. For those whose math skills allowed it, this was a good way to illustrate the effects of late homework. After a certain period of time, still-missing spelling homework was graded zero. Since the spelling grade was an average of test scores and the homework grade, it was easy to show how good test scores could be negated by neglecting homework.

Apart from child instruction, the in-room computer proved to be a valuable aid to the teacher and provided a source for clear, highly readable teaching materials and communications with parents and other staff members. The gradebook saved hours of calculations. The class database could be used for everything from mailing addresses to dates for legally necessary I.E.P. (Independent Educational Plan) conferences. Another database kept track of the purchases for this project. Each week, 20 column *Magic Slate* print was used to prepare lists of reading words for each group taught. Some children used behavioral checklists made on the computer. Information for substitute teachers could be kept on disk and customized for each use. Finally, parents were sent clear typed copies of homework obligations and special class occurrences. The computer and the copier not only made clearer copy, they were faster than handwritten dittos.

Meeting Individual Needs

The third major focus of the proposed project was the use of the computer for the additional drill and practice usually required by learning disabled students in one or more areas, and the use of the computer to address needs unique to one individual. An example of the latter is a difficulty with word retrieval. This need could be assisted by lessons that gradually phase out spoken words.

The computer was closely scheduled most of the morning for general group use, but it was available for individual pursuits during the math period. Two lessons were developed on *MicroQuest*, and *Math Blaster* was used for drill and practice when children came close to mastery of basic facts in addition or subtraction. The practice sections of this pro-

gram would be good for most children at any time, but these children preferred the game very strongly. It does not allow any time for calculation and is not very useful to a child who hasn't memorized most facts.

The computer was used to meet the individual needs of students in ways totally unforeseen in the original proposal. A bright, highly motivated child had spent the two previous years in the class and was academically far ahead of all the others, particularly in language skills and written expression. He did not need to participate in many of the lessons provided for the rest of the class and was free to use the computer when they couldn't. He used the *Hartley Capitalization* program, learning and practicing most of the rules on his own. His reading skills were such that he could enjoy *Dragon's Keep* (interactive fiction) without much help. This made constructive use of his time and saved considerable instruction time for the teacher.

Two students required more specialized help. Both children read at or above grade level and both were holding their own in regular language arts classes. They shared a weakness in word recognition for which they compensated by using context and other strong comprehension skills. With these two children, the *Talking Text Writer* was used for instruction and for individual practice. They were taught some fundamental rules of syllabication insofar as they were helpful to decoding. The reading they were assigned in their regular classes was screened for difficult words, and these words were typed on the screen, sometimes by them and sometimes for them. With increasing degrees of independence, they divided the words into pieces with the synthesizer providing immediate check in its pronunciation of each syllable. The words could be put back together and reread with the delete key. At the end of a session the words could be printed whole or in parts for later practice and review. This procedure proved to be motivating and effective.

This is a tiny taste of what a computer can do to meet the individual needs of children. It is likely that available programs do not address many of the special needs of the learning disabled and that extensive authoring may be required. To that end, *E-Z Pilot*, which can be used with or without the synthesizer, was purchased for the project.

Evaluation

Goal 1—Students will demonstrate proficiency in word processing, using a database and spreadsheet, and in using the computer to assist their own learning in areas of weakness.

This goal will be evaluated in three parts.

Proficiency in Word Processing

For the end of the year assessment, a checklist of word processing skills was compiled and students were checked informally for the items on the list. As it appears below, the number of students who demonstrated such capabilities precedes each skill.

9 type words
9 delete letters, words
9 write upper and lowercase letters at will
9 use space bar appropriately
8 make numbered lists, formatted, skip lines
4 use return for paragraph in composition
6 use age appropriate punctuation keys
2 move cursor efficiently to desired location
1 controls type over, insert modes
8 save work
9 type original sentences
9 copy handwritten composition
0 copy handwritten compositions without omissions
1 writes original composition on computer
0 use spelling checker (not yet attempted)
2 type 10 words per minute (Appendix B)
1 underlines
1 uses bold type
1 uses shift to print any symbol

The above list indicates that all children were able to copy their compositions on the computer with varying degrees of competence. One student, whose reading skills remained at an early first-grade level, needed a spotter to focus his attention and help him keep his place. Another, whose skills were little better, managed somehow to do it on his own. Most children did not work efficiently. Only two really understood that it was not necessary to track the entire page with the cursor in order to get to the correction they wished to make. All were at least willing, and some eager, to type their stories, however long it took.

It was a stated hope of this project that using the computer for composition would help with the pervasive problem of omissions (words, endings) among learning disabled students. The above zero does not erase that hope entirely. Two students were able to turn in stories without obvious omissions when they used *Talking Text Writer*. The omissions were whole sentences or words that occurred in the handwritten original. One student occasionally omitted words from his home word processing (no synthesizer), but his work was increasingly perfect in its mechanics. The others were only beginning to use the synthesizer for real checking. It is possible that as all their skills mature, they will be able to focus more clearly on mechanics.

Another student did demonstrate in almost every way the boon of word processing to at least some children with learning disabilities. For a child who is overcoming severe reading problems and has avoided handwriting since it was introduced in first grade, the computer has allowed him to distinguish himself and take great pride in his creative writing. The computer does close the gap between what he should be able to do and what he can do in the area of written expression. Because of the clarity of the computer printout, he can also read what he has written, even though he has residual perceptual problems. Among the most intelligent of the students, it has served as an incentive to increase his skills in grammar and punctuation. He regularly asks questions of progressively higher order about quotation marks and commas, and uses his knowledge in his writing. His success can be attributed in no small measure to the many faceted support of caring parents who understand the value of allowing him full use of the family computer, but he also honed his skills in the classroom where his particular

needs were focal. He exemplifies the hoped-for outcome of this project.

A quick check of the book, which is roughly chronological by month of writing, shows how much longer stories were toward the end of the year. Growth of skill and maturity accounts for some of this, but the book appeared to provide a powerful incentive to both quality and quantity.

Using Database and Spreadsheet

The hoped-for experiences with information storage and retrieval had to be postponed during the first year of the project (at least). Most students needed more time than originally was contemplated to achieve success in other computer uses, with unscheduled computer time at a premium.

Students did learn to read a weekly spreadsheet that tracked their academic and behavioral achievements in the classroom.

Computer Assisted Learning

This first goal limited itself to the ability *to use* the computer in order to learn. In the Fall, only one student had prior experience with loading programs into a computer and using them. Accordingly, another list was devised cataloging skills needed to access and use available programs of all kinds. In the following checklist, the numbers at the left indicate the number of students who demonstrated each skill.

8 find shift, control, Open Apple, space bar, return keys
9 use space bar, return to select options
5 access program efficiently through menu after introduction to program
1 accesses program through menu independently
6 use two-key commands (such as Open-Apple 4)
8 change within a program to other options (such as print)
8 reset computer for new program
9 handle disks, materials with appropriate care

All the children were able to use some programs unassisted, but the checklist indicates varying degrees of independence. Some children needed assistance to get to the part of the program they were to use. With a little practice, all could carry on from there in the programs used, even if they couldn't read every word of instruction. They appeared to learn the program format and to know what to do or that they were to wait.

Goal 2—Students who participate in the project will demonstrate greater improvement in those skills targeted for computer assistance than learning disabled students generally show after a similar period of placement in a special class without a computer.

The evaluation procedure for this goal was to have been a comparison of a children's progress in a given skill with their progress in previous years. This was not possible because of the unique nature of this particular class combined with changes within the school district. Teacher observation, however, indicated that five of the eight students in the class either achieved their potential or moved significantly toward it. Progress for the others was disappointing. Considering all the factors—social, emotional, and environmental—which seemed to operate in the performances of these children, the computer cannot even be suggested as a single important influence. With one exception, the achievers come from families that appear to be more secure financially. They seem to be mainly the children who got more support from home. As influences on academic achievement, it would appear that classroom activities pale in importance beside some environmental considerations.

Goal 3—Students will show sufficient improvement in targeted basic skills to demonstrate the need for computers in all classrooms for learning disabled students.

This goal was dependent on demonstrating outstanding group achievements on the second goal. While the above results, even in their most favorable light, are inconclusive, the project leader is still convinced that computers are important tools for learning disabled students.

Based on clinical observation rather than test data, many unanticipated outcomes suggest the value of the in-class computer. These events are not measurable, but seem nonetheless valid.

First among these was the computer's motivational potential. The book, impossible without the computer, fostered motivation to achieve academically as nothing else did all year. Just the potential of inclusion in the book raised the quality and quantity of written output, even among these language handicapped children.

Known to be an effective, nonjudgmental teacher for all, work at the computer also seemed to offer special satisfaction to the two most disruptive children in the group. Time at the computer seemed calming, and the desire to demonstrate expertise seemed more motivating than most other academic work.

The computer provided all the children with moments of satisfaction and success, all too rare in this group. They were pleased with themselves for typing speeds, for their computer pictures, and for the power they felt when they could make the computer print. Two children seemed to draw real self-esteem from their general computer expertise. One was an extremely shy child whose test scores would suggest the most limited ability in the class. Quite remarkably, his success with the computer seemed to give him status and confidence. The incentive provided by the book apparently helped him to overcome a real block to creative writing. He was the child who could not respond with more than a sentence in the fall. By spring, he was recognized as a "great" author of multipage stories.

Early familiarity with a computer would seem to be an advantage to children with learning disabilities. They will have as many, if not more, reasons to use a computer as other students. Among the benefits are clear visual fields and greater ease of writing. It was surprising to the project leader, therefore, that five former students, now college-bound high school graduates, separately reported that they were unable to use computers. They had had the regular high school courses, but, they implied, their learning disabilities made

computer use impossible for them. Considering the fact that none of these students had as much to overcome as the second graders in this project, their reactions seem to be based more on fear or lack of sufficient exposure than on real inability. The computer in the special classroom would seem to provide the early extra help that makes these students confident and equal to others in the mainstream.

Conclusions

The project continued until the teacher's retirement in 1989. No other teacher in the district has replicated it. In spite of the lack of hard evidence, clinical observation from this project makes a strong case for having computers in learning disability classrooms. With computer use steadily increasing at all levels throughout the district, it seems inevitable that learning disability classrooms on every level will be equipped with computers over the next several years.

Because of the nature of the students and the variation from class to class, this project should be used more as a resource than as an agenda to be followed. The curriculum objectives and what the children were taught to do with the computer could form a basis for curriculum for other classes. More than that, curriculum materials, like the checklists, provide starting points for other teachers.

This project, in exposing almost every student to each piece of software, can yield important insights into relationships between handicapping conditions and various programs. *Talking Text Writer*, helpful to most students, seems a poor choice for children with severe visual perceptual problems. *Compukeys* and *Paint with Words* seem almost universally useful; they would make good initial investments. *MasterType* might be better used with more mature students. Other teachers would not have to start from scratch.

The project leader's experience should be tapped in helping others adapt their programs , particular class compositions, schedules, and previous computer experience to using computers in their classrooms. The use of the plural, computers, is deliberate, for the scheduling difficulties mentioned throughout this report have convinced the writer that at least two computers should be provided to each class, one for use in instruction and assisted learning, and another for repetitive and time consuming tasks like keyboarding and word processing.

A final hope would be that the district would provide considerable consultation and help to teachers in order to help them get started using and feeling comfortable with computers. It became clear to the project leader that enthusiasm and the equipment were not enough. Most experienced teachers, like the project leader, have learned anything they know about computers on their own, and some have never used one for any purpose. An effective computer program requires teachers comfortable with what they're doing and well versed in the special characteristics of each program they use. It requires time to review each program in order to decide how to present it and to find the possible pitfalls for the children. Time to prepare for this new curriculum must be found in an already full day. Ideally, at least one full-time consultant to the 19 district classes should be provided, and teachers should be encouraged to take on their programs at an unpressured, comfortable speed.

Additional Suggestions

Time and the lack of it has been a constant theme in this report. Teachers who attempt a similar program should look hard for the time saving potential of the computer. Feel free to spend money for programs that assist only the teacher, for the time saved comes back to the children. I erroneously assumed that all money spent should provide direct service to children. I never understood why I was urged to buy *AppleWorks*, for example, until I saw its myriad applications in a special classroom where so many detailed records are kept.

The time spent on keyboarding in this first year, rewarding as it was eventually (in word processing), was probably excessive. Even the "experts" at Closing the Gap were divided as to the importance of when to start keyboarding. Some felt children should never be permitted to "hunt and peck," and others felt that they should be permitted to explore the keyboard before they began the discipline of keyboarding. The writer was cautious, following the old notion that you should never promote anything that would have to be unlearned. It appears that children take a long time to develop fingering habits, correct or incorrect, so perhaps more time to explore the keyboard in a more entertaining way is permissible.

Finally, as with most other materials in a classroom for students with learning disabilities, teacher-made, closely targeted materials will probably prove to be the most effective. As with any other commercially available classroom products, many programs are not quite appropriate for these particular students. Because of this, developing authoring skills should have high priority.

CHAPTER 10
THE WRITE WAY

A Language Arts Program for Orthopedically Handicapped Students

by Lauri Kuchmaner

Abstract

The Write Way project targeted the speech and language skills of severely orthopedically handicapped students in grades K through 12. Activities included a monthly newsletter for students in kindergarten through twelfth grade, a book building project for students in grades one through six, and a career awareness notebook for students in grades seven through twelve. All students contributed articles to the newsletter *Accentuate the Positive*. Sometimes parents were asked to write articles in collaboration with their children. Articles from the lower grades were sent to the high school, where students used either a word processor or *Newsroom* to enter the articles and lay out the columns with the teacher's help. Several of the middle school and high school students were able to write their own articles, using adaptive hardware devices when necessary.

The book building activity centered around software that encouraged offline activities preceding the computer work. Prompts guided students through a series of writing skills. At the end of each language skill lesson, students printed pages for their books. The finished copy included cover, title page, alphabet page, personal information page, and pages of developed language skills.

The middle and high school students listened to handicapped adult speakers working in a variety of fields and had computer access to *Career Planning System*. The students kept career awareness notebooks including printouts from the *Career Planning System*, their own notes (written on the word processor when possible) on the guest speakers, and their own ideas about future career plans.

The students in the orthopedic program generally have poorly developed oral and written language skills. By combining technology with the teaching of language development skills, the students were able to communicate in ways which were impossible for them before. The newsletter gave all the students pleasure in seeing their own work in print. The high school students took pride in the responsibility for planning the layout of the younger students' articles. The book building projects enabled students to have a personal professional-looking collection of their classwork. For most students, this was the first time they were able to create legible printed work on their own.

Background Information

Target Population Profile

Twenty-four students with orthopedic handicaps participated in the project. They were physically handicapped to varying degrees. Their handicaps were the result of cerebral palsy, spina bifida, muscular dystrophy, and other handicapping conditions.

Student ranged in age from 5 years, 11 months to 17 years, and from kindergarten to grade 12. They attended one of the five orthopedic units that are housed in the Lakeview School District, but may reside anywhere within Trumbull County. Twenty of the 24 students also participated in speech-language therapy as part of their individual education program.

Description of the Inequity

The degree of success with which our orthopedically handicapped students are able to function in the future will depend on their ability to use technological tools. In order to reduce the educational inequities caused by their physical handicaps, we are utilizing accessible microcomputers as a tool to address three central issues of learning: language, motiva-

tion, and access. By combining technology with a vital curriculum need, we hope to prepare our students for future vocational and educational pursuits.

Goals

1. To improve oral and written language skills utilizing the whole language approach and word processing.
2. To improve student motivation and self-concept by exploring careers, setting personal goals, and independently completing tasks.
3. To enhance access to content and experiences via accessible microcomputer use.

Project Description

The major activities of our project were as follows:

A. Monthly Newsletter—(All units K-12)

Software used: *Newsroom, Newsroom Clip Art, Graphics Expander Vol. 1*

1. Students were assigned and volunteered for various jobs of interviewing others, reporting on events, field trips, language experience stories, and special services specific to handicapped/disabled persons.
2. Students incorporated language skills into their articles, such as sentence combining, descriptive words, antonyms, homonyms, synonyms, full sentence use, dictionary use, etc.
3. Students were responsible for completing assignments and typing articles for the newsletter using word processing.
4. Parents were encouraged to submit articles of interest that had been written with the student, and to assist in student assignments (example, interviewing family members).
5. Students printed out the newsletter before final monthly distribution to all parents, staff, and administration.
6. Students used the finished product for reading.

B. Book Building—(primary and intermediate units)

Software Used: *Magic Slate, I Can Write!, Be a Writer!*

1. Students participated in a book building venture in which they explored a wide range of composition activities and word processing functions. The writing ranged from open-ended exploration of the student's identity to more formal language objectives. When the students completed all of their assignments the printed work was assembled into a bound book 25 pages in length.
2. Students used their completed books for reading.

C. Career Awareness Notebook (junior and senior high units)

Software Used: *Career Planning System*— Format II Short Version

1. Utilizing computer software, speakers, and films, we actively involved the students in planning to (a) learn about their personal interests, (b) examine occupations to see how they relate to their personal interests, and (c) identify areas of study in which their personal interests may be nurtured and in which related skills may be developed.
2. Using word processing, students completed a notebook that included (a) self- evaluation of marketable skills; (b) information on five possible career choices, including necessary skills, anticipated demand, salary, etc.; and (c) an essay on the career the student would most like to pursue with goals and plans to obtain the necessary skills.

Chronology of Activities

September, 1986

Our project activities began with pretest assessments, conducted by the project coordinator, the Speech-Language Pathologist. Since the goals of our project included developing oral and written language skills while gaining access to microcomputers, test measures selected and given were in the area of speech and language. Oral and written language samples were collected between the months of September and October, 1986.

December, 1986

The 10-page December, 1986 issue of *Accentuate the Positive* came off the press without a hitch as it had in October and November, thanks to the students and the high school classroom teacher. The newsletters were distributed to each of the students. They immediately leafed through them, smiling and chattering, looking for and finally locating the article they had written. Smiles grew broader. "Hey Andy!" yelled Jamie, "Here's my story." As Jamie read, Andy listened intently. Both laughed intermittently. "That's great!" Andy said as he nodded in approval. "Wow!" I thought, "One activity—goals accomplished—oral language, written language, motivation, self-concept, access!"

The orthopedic program had three microcomputers for full-time use: Apple IIe, Franklin Ace 1000, and Commodore 64. Keyguards were purchased through grant funds for each of the computers, allowing access to some students who otherwise could not participate due to fine motor impairments. One high school student with no functional use of her extremities communicated via the microcomputer with a head stick guided by the keyguard. Another is now able to strike the keys manually. The Adaptive Firmware Card and software have allowed an even more severely handicapped student to access the computer by striking a single switch. Although a time consuming and laborious task, he has

utilized word processing to write short letters and other written language activities.

January, 1987

The newsletter activities continued to be successful throughout the remainder of the school year. The high school and intermediate students were expected to type their own articles using word processing and were encouraged to help the younger students who could not do so for themselves. The older students were also involved in the layout and printing, and in distribution when time permitted. All students (K-12) were encouraged to volunteer ideas for their own articles, but much of the time topics were assigned by their classroom teachers. Because many students in the primary units have not yet developed the skills necessary for writing, the two primary teachers often collected spoken language samples from each of the children following an activity or an experience. These samples appeared next to the student's name in the newsletter along with the teacher's description of the activity.

February/March, 1987

We initiated our book-building activities with the students in the primary and intermediate units. The *I Can Write!* and *Be a Writer!* software programs are a collection of 25 files or pages with a variety of language and word processing activities. The teacher introduces the new concepts and terminology in a brief lesson with the entire class. Each student had his/her own personal data disk so that files could be edited, saved, and printed at any time. We found that printing each file immediately upon completion was optimal because the student could see and hold the final product. We encouraged the students to draw pictures, copy alphabet letters, label, etc. on their pages to promote maximum skill development. It was also helpful to have two students working at the computer together, switching roles as participant and helper. There were three students at the primary level whose reading skill levels were at or below letter identification. For those students, the teacher typed in the information, but involved the student at the computer as much as possible.

April, 1987

The *Career Planning System* was introduced to the high school units. In this system, students complete an interest sort by responding to questions about what they like to do "a lot," "a little," or "not at all." This information is then evaluated by the system and a list of possible careers is presented for the students' consideration. Students then "meet" a worker who explains his or her career. They are given "hands-on" activities to complete, after which the teacher conducts an exit interview with the student.

April/May, 1987

Three guest speakers were invited to talk to the high school orthopedic students during school hours. Parents were encouraged to attend, however the turnout was disappointing with only one set of parents attending one presentation. The first speaker was from Goodwill Industries and spoke to the students about sheltered employment opportunities, the procedure for applying, what constitutes a good employee, and the skills needed to perform the various jobs at Goodwill. He also spoke about the Goodwill apartments for the handicapped and about independent living. The second speaker was the manager of a successful telephone solicitation company. He outlined the job requirements and answered questions that the students had, such as "Do you have to have your own transportation?" (yes), and "Would I be able to do this job?" (If you concentrated on your speech skills). The final speaker was a young woman with cerebral palsy who was employed in the high school building as a part-time secretary. She described her duties as a secretary and noted that typing was her weakness due to her physical limitations. She also talked openly about the trials and tribulations of seeking a college education and gainful employment as a handicapped citizen.

By the end of May, our eighth monthly newsletter of the year was distributed. The primary and intermediate orthopedic students had completed approximately one half of their books, and the high school students had completed their interest sort summaries with the *Career Planning System* and had begun exploring careers.

September, 1987

The beginning of the school year brought some new problems to the project activities. Three of the high school students transferred to the county vocational school, making it impossible for them to continue participating in the project. Several other of our Primary I students had surgeries and were absent through the end of 1987. Our numbers were decreasing rapidly. In addition, the students in the Primary II unit had little time in their 1987-88 daily schedules to complete their book-building pages at the computer. We found this to be our most frustrating problem. Many of our students are mainstreamed into the regular education program for one or more academic subject areas. In order to keep up with the assignments, most of these students required extra tutoring with the special education classroom teacher. In addition, the students receive physical, occupational, and speech and language therapy, each two times weekly.

Despite the time demands, project activities continued during the month of September. The new substitute teacher at the high school found that the *Career Planning System* was most efficiently used in a group setting because of the inherent limitations of the software program. The students had begun to explore careers individually, but each career took 45 minutes to one hour at the computer and could not be stopped and returned to at a later time without beginning the whole program over. The students also demonstrated difficulty answering the questions on the reaction forms in their student booklets. The questions were vague and often required clarification from the teacher.

October, 1987

The intermediate students had by now become increasingly excited as they saw their books taking shape. They enjoyed using the Sunburst *I Can Write!* and *Be a Writer!* programs and were becoming more proficient in their use of the word processing functions of the program. They now independently assumed responsibility for completing their files, and they did so quickly. This group of students had the most

success with the book building venture, largely due to the class being relatively small and self-contained.

In October, the intermediate students had also begun to take more responsibility for the typing and layout of their newsletter articles. They enjoyed creating the publication from beginning to end.

December, 1987

By early December the intermediate unit had completed their books, which were then bound and used for reading in the classroom. The students expressed a sense of accomplishment and independence in having created their own books.

The high school students had explored five careers using the *Career Planning System* software, and several of the students expressed interest in pursuing one of the careers that had been probed.

The primary students had completed most of their files with the Sunburst *I Can Write!* book-building program and looked forward to working on the next file. The third 1987-88 issue of *Accentuate the Positive* was distributed in December.

January, 1988

The high school students continued to investigate careers with the *Career Planning System*, but unfortunately their career awareness notebooks had not developed as had been initially planned. This was mainly due to the extended time it took to complete the individual career units and frequent student absences, which were unavoidable.

By January, one high school student, Andy, had become proficient at word processing using the Adaptive Firmware Card and a switch that he activated with his knee. Andy is now able to express himself in written form, which was impossible for him before the project was initiated.

Posttesting was conducted with those students who were involved in the book-building and career activities, and written language samples were collected for comparison with pre-samples.

Although this was the end of the scheduled project, The Write Way has continued as part of the ongoing program using the hardware and software purchased with grant funds. It is supervised by the speech pathologist and the teachers of the orthopedically handicapped classes. The monthly newsletter will continue indefinitely since the students' activities, feelings, and language skills continually change, and because of the obvious positive effect it has had on motivation and self-concept. The project has been presented to other special educators in the area by the county speech-language supervisor and will hopefully create interest in replicating the project with students exhibiting other handicapping conditions.

Evaluation

Standardized Testing

Standardized pre- and posttest evaluations were given to the students who participated in both the monthly newsletter and either the book-building or career awareness activities with the exception of one student in the intermediate unit for whom pretest data was unavailable.

The primary and intermediate students were given the Peabody Picture Vocabulary Test (PPVT)—Revised Form L, and either the Test of Language Development (TOLD) Primary or Intermediate Forms, depending upon the student's chronological age. Standard scores were obtained for overall language performance (Spoken Language Quotient), listening, speaking, semantics, syntax, and receptive vocabulary (PPVT).

All standard scores (quotients) reported are based on a mean of 100 and a standard deviation of 15.

Overall Language Performance

Nine of the 20 students (45%) showed increases in standard scores on either the TOLD Spoken Language Quotient or the TOTAL Adolescent Language Quotient. The average scores by unit revealed the following differences between pre- and postassessments.

Primary I	-4
Primary II	+12
Intermediate	+18
High School	0

Based on the TOLD Pro-Score Analysis, 3 of the 13 primary and intermediate students' pretest performance was considered average (23%), three below average (23%), and seven poor (54%). Posttest analysis revealed seven average (54%), two below average (15%), and four poor (31%).

Listening Quotient

Eleven of the 20 students showed increases in their listening skills. The average scores by unit revealed the following differences between pre- and posttest assessments.

Primary I	-13
Primary II	+15
Intermediate	+11
High School	+6

Based on the TOLD Pro-Score Analysis, 3 of the 13 primary and intermediate students' pretest performance was considered average (23%), seven below average (54%), and three poor (23%). Posttest analysis revealed seven average (54%), one below average (8%), and five poor (38%) scores.

Speaking Quotient

Fifteen of the 20 (75%) showed increases in their oral language performance. The average scores by unit revealed the following differences between pre- and posttest assessments.

Primary I	+2
Primary II	+7
Intermediate	+22
High School	+6

Two of the 13 primary and intermediate students' performance was considered average (15%), five below average

(38%), and six poor (46%). Posttest analysis revealed seven average (54%), two below average (15%), and four poor (31%) scores.

Semantics Quotient (Primary and Intermediate)
Nine of the 13 (69%) students showed increases in their semantics performance. The average scores for each unit revealed the following differences between pre- and posttest assessments.

Primary I	-1
Primary II	+17
Intermediate	+15

One of the thirteen student's pretest performances was considered average (8%), seven below average (54%), and five poor (38%). Posttest analysis revealed eight average (62%), one below average (8%), and four poor (31%) scores.

Syntax Quotient (Primary and Intermediate)
Seven of the 13 (54%) students showed increases in their syntax performance. The average scores by unit revealed these differences between pre- and posttest assessments:

Primary I	-7
Primary II	+6
Intermediate	+9

Two of the students' pretest performances were considered average (15%), six below average (46%), and five poor (38%). Posttest analysis revealed six average (46%), two below average (15%), and five poor (38%) scores.

Reading Quotient (High School)
None of the six students showed any increase in reading skills. The average pre-and posttest scores were 56 and 54 respectively, a decrease of two points on the average.

Writing Quotient (High School)
Four of six students (67%) showed an improvement in their written language skills. The average pre-and posttest scores were 56 and 59 respectively, an increase of three standard score points.

Receptive Vocabulary
Fourteen of the 20 students (70%) showed increases in their standard scores on the PPVT. Differences in the average pre- and posttest scores for each unit were as follows:

Primary I	+3
Primary II	-1
Intermediate	+7
High School	+2

Written Language Samples
Pre- and postsamples for 13 of the students were available for analysis. Several of our Primary I students had no measurable written language both before and after the project term. Several other students' presamples were not completed prior to initiation of the project activities for other reasons.

Informal analysis revealed increases in the average total words per sample (pre 25, post 56), complete sentence usage (pre 65%, post 94%), appropriate use of capitalization (pre 53%, post 61%), and appropriate use of punctuation (pre 40%, post 49%). In addition, 9 of the 13 (69%) students showed improvement in spacing, and 12 of the 13 (92%) students showed improvement in the overall appearance and legibility of their handwriting.

Teacher Evaluation Summary

Four of the five orthopedic teachers responded to the Teacher Evaluation Summary.

Impact of Project Activities. In general, the teachers agreed that the monthly newsletter, "Accentuate the Positive" was an extremely valuable tool in the classroom. The book-building programs, *Career Planning System*, and speakers were also considered valuable as to the impact they have had on the students.

Achievement of Project Goals. The teachers indicated that 10 of 24 students (42%) improved in their oral language skills as a result of the project, 17 (71%) in their written language skills, 16 (67%) in motivation, 15 (63%) in self-concept, 6 (25%) in their ability to set personal goals, and 7 to 8 in their ability to complete tasks independently.

Access to Content and Experiences. The four teachers felt strongly that the project activities enhanced students' access to content and experiences.

Continuation of Project Activities. The teachers were in general agreement that the monthly newsletter, book building, and career activities should continue in the future.

Summary

Overall, the Primary II unit students and the intermediate unit students showed the greatest benefit from the Local Action Project activities. We believe this may be due to the appropriateness of the software and activities for this particular group's age and ability level.

Oral language, written language, motivation, and self-concept showed greater increases than did the students' ability to set personal goals and to complete tasks independently.

The ability of all students to access content and experiences via the microcomputer and the adaptive devices that were purchased through grant funds was obvious. Students who had either no written form of communication or who could not access the microcomputer are now doing both.

Additional Suggestions

The Write Way project is one well worth replicating. All of the activities implemented were realistic for most of our orthopedically handicapped students. Because our project included many activities for a variety of student ages and grade levels, the entire project would be inappropriate for implementation within a single classroom.

The newsletter could be used for any age or grade. Our newsletter usually ended up being about five pages (front and back). A smaller group of students might produce a newsletter with fewer pages. A newsletter of any length, though, is a worthwhile venture that we recommend highly for any educational group.

Teachers were asked to comment on the project activities. Their responses follow.

Primary Orthopedic I

"I feel that the newsletter has greatly benefited my language/reading programs. The newspaper also helped parents learn about our program and special events."

"The book-building *Magic Slate* program had great potential for expanding creative thinking skills in my class. Since my students are very low both academically and motorically, there was great difficulty finding the time to do this project. Each child needed one-on-one for long periods of time. It is difficult to do this and have others do constructive activities."

"I've enjoyed both projects. I feel the speech-language pathologist put many long hours helping us. It was just the time factor that made it too pressurized."

Primary Orthopedic II

"My class had difficulty participating in the project. We ran into unavoidable scheduling problems. I was on maternity leave for half of the projected time, and the substitute found it difficult to participate in the project (book building). I had one student withdraw from school who was to participate in the project. Due to these problems, half of my class did not get to participate. When the grant was written, we could not have foreseen these problems. I feel they have affected the results of the grant in a negative way. The grant would have been very beneficial for the three students I had who did not participate. I would like my class to participate in grants in the future but feel we need to look at problems that might hurt their participation."

Intermediate Orthopedic

"My students enjoyed working on the computer. They were anxious to complete their seatwork to get time on the computer. Students enjoyed 'Book Building' computer work, as well as drawing pictures to illustrate their work. All students were very proud and thrilled to have written a book. They very much felt a sense of accomplishment."

Student comments

"I told my mom I have a surprise for her. I can't wait to take my book home."

"I feel proud of my book."

"The newsletter increases student practice at sentence construction, punctuation, capitalization, sequencing of events, spelling, and working independently. The computer and software are invaluable tools for our physically handicapped students, some of whom would not have a written form of communication otherwise. Thank you!"

High School Orthopedic

"Most of the students in this class completed the introduction and the interest sort in late spring of 1987, under the guidance of a different teacher. This fall, the students began the investigation of the various interest areas. Although the activities are designed to be used on an individual basis, this was impossible due to time restraints and these students' abilities. The students' reading and perceptual difficulties made it impossible for them to complete each activity in a reasonable amount of time. Also, because of the amount of time it takes to complete each area, the students' interest tended to wane. To solve these problems, many of the interest area investigations were conducted in a group setting. The groups consisted of four or five students who took turns operating the computer and reading. The students polled one another to answer the questions and complete the activities. The teacher was present at all times to guide the students through each activity."

"The students enjoyed most of the interest areas we have investigated. Many of the activities that consisted primarily of math problems did not appeal to most of the students. The students particularly enjoyed the activities in which they could make decisions, as in the "Cook" interest area. However, the time factor was still a problem. Each interest area takes over an hour to complete and the program could not be stopped in the middle and returned to at a later time. It would be helpful if each interest area was divided into segments which could be chosen and worked on at different times."

"Each student filled out a Reaction Form for each activity. The forms were somewhat vague for this particular group of students. They had difficulty distinguishing between 'What did you like MOST about this activity?,' 'What did you do BEST in this activity?,' and 'What do you think you'd like MOST about this activity?' Perhaps it would be clearer to the students if the questions were more specific to each interest area."

Chapter 11
Hands On—A Training Model For Peer Tutors

by Madeline Rosenshein

Abstract

The Peer Tutor project was implemented in a ninth-grade learning/behavior disabilities class. Students in this class had reading skills as low as the second-grade level. They had a high absentee rate and were generally considered too disruptive to be in a regular classroom setting. The peer tutoring aspect of the project had two components: students helping other students within the classroom and students helping students in other classes.

The students were given basic instruction in computer operations, word processing, and a broad range of instructional software. They worked on writing and problem solving projects in groups of two or three. These cooperative ventures were unusual learning styles for the students, but their mutual fascination with the computer overcame their tendency to shun cooperation. After experiencing the dynamics of group interaction, the students were teamed with students from other learning disabled classes (not behaviorally disabled) and became their peer tutors—instructors of computer applications, word processing, and problem solving.

The psychological impact of the peer tutoring cannot be underestimated. The project students did not *fit* in a regular classroom; they accepted failure in many areas, both academic and social. The peer tutoring of computer skills served two functions. It focused students' attention on academic skills that were previously unattainable, and it provided them with an opportunity to function successfully both academically and socially.

Background Information

Target Population Profile

The group consisted of ninth-grade students with learning/behavior disabilities who were in a high school Learning Disabilities Resource Room. The class started with 10 students when the school year began and ended with six students in June. Four students either dropped out, were suspended, or expelled.

Description of the Inequity

There were not enough computers and software in special education classrooms and no integration of computers into the special education classroom curriculum.

There were no peer tutors who were handicapped and could serve as role models for other special education students.

Goals

1. To integrate computers into the special education classroom with student based training and peer tutors.
2. To develop a training model for peer tutors that can be replicated in otherspecial education classrooms and school districts.

Project Description

Phase I—Early Planning

Special Education Computer Consultant

Special Education Resource Center personnel provided a one-day introduction on computer use and software selection to the students and teacher. A room in the library was equipped with five computers from the school, and students spent the day using some tutorial software, drill and practice software, and simulation software along with some alternate keyboards and a speech synthesizer. What was quickly discovered was the short attention span of the students, the need for a variety of approaches, and the typical antics of ninth grade students.

Oregon Trail, a simulation software that has the students taking a wagon train out west, was the hit of the day. This was presented in a group and provided a lot of opportunity for interaction and discussion of decision making and problem solving necessary to successfully reach Oregon. Two important observations occurred that day. A student from another class came in to deliver a message to the teacher. When she found out that the teacher wasn't there and the students didn't know where she was, she started calling the students "dumb" and "retards." Later on, some other students who were between classes started asking the students in the workshop why they got to use the computers all day. One of the students replied, "We're special." I think both of these small incidents point to the problems of low self-esteem that special education students experience and the opportunities that the computer can provide to raise self-esteem and self-confidence. This effect has been pointed out in the literature, but often is only supported by anecdotal material.

Given the beginning computer skill level of the students and teacher, it was probably more appropriate to use Special Education Regional Resource Center (SERRC) personnel for this introductory session than a computer consultant. It was also a good opportunity to introduce SERRC staff who would be working on the project to the students and for the staff to familiarize themselves with the students.

Peer Tutors

Originally, I wanted to choose two peer tutors based on previous experience and interest in computer use and a day of observation in a computer workshop. This did not prove workable since some of the students who had knowledge did not know how to share this knowledge with other students or could not stay after school for additional study with the teacher (part of the original plan). Some students worked parttime after school or were active on a sports team. Larson and Roberts (1986) described a study in which the most positive results occurred when students were given the opportunity to share their computer skills with other students in a tutoring program. The author and classroom teacher's initial assumption was that modeling supportive behavior at the computer for the students would cause this behavior to occur in the students. This article prompted a reexamination of the idea of the tutors naturally emerging in weekly computer sessions. The importance of setting the tone for this supportive environment was also emphasized in this article. My premise in pursuing this project was the assumption that peer tutoring for learning disabled students would increase both computer skills and self-esteem of the students. This was not borne out by a review of 24 studies of peer tutoring with learning disabled students (Scruggs & Richter, 1986). Although the studies did not center around using the computer in peer tutoring, most centered on single subject areas and almost all directly assessed academic benefits to the recipients of the tutoring. Eleven of the studies employed learning disabled or reading disabled students as tutors. Other variables that were evaluated were academic benefits to tutors and social benefits to tutors and students. Almost all of the authors in the review appear convinced that this intervention has merit, but empirical evidence is lacking because of differences in the methodology used to study the topic. In the area of accrued social benefits (improved self-esteem, self-confidence), anecdotal reports were the only evidence.

Classroom Teacher

When I enlisted the help of a local school administrator to secure a classroom teacher and a group of learning disabled students for this project, I sought a teacher who had some computer skills, but had not had the opportunity to integrate the computer into the class curriculum. However, the local school administrator saw this project as an opportunity to provide computer training to a teacher who was not computer literate and to a class that was not using computers. This turned out to be the best approach. Several of the articles on peer tutoring and cooperative learning suggested that these methods succeed more often when the teacher is not viewed as the expert, but as someone who is exploring computer use with the students and who could encourage reciprocal support between teacher and student and student to student.

Phase Two—Implementation Phase

The project leader met with the classroom teacher from September to November on an almost weekly basis to review software that would be used in weekly sessions with the students. Peer tutoring and cooperative learning activities were incorporated into these weekly sessions. Some peer tutoring activities include:

1. Demonstration and practice using a software program such as *Print Shop* for the experimental group followed by having the experimental group teach it to the control group (another learning disabled class next door).
2. Segmentation of the experimental group into two groups with each group choosing educational software, learning to use it, and then demonstrating what they have learned to the other group.
3. Use of the students in the class to teach some computer activity that they have mastered to an elementary class.

Cooperative learning activities are an integral part of peer tutoring because success is only possible through group effort and helping each other. In the traditional classroom, students are expected to work on their own and there is little incentive for helping.

The first session was held with the students on November 12 using *Print Shop* and *Lemonade*.

Highlights of these sessions included:

- Students used a word processing program to write letters to a local radio station requesting promotional items.
- Students wrote brief poems using *Magic Slate*.
- Class took a field trip to a Toyota dealer to learn how computers are used in the workplace.
- Class designed a survey about rock groups and compiled results using *Survey TakeSoftware*.
- Class demonstrated *Car Builder* software to a fifth through sixth grade learning disabled class. The younger

students also demonstrated *Where in the USA is Carmen Sandiego?* to high school students.

Conclusion

It was hoped that students with peer tutoring/cooperative learning experience would show greater gains in personal worth, self reliance, and social skills. However, pre- and posttesting using the personal worth section of the California Test of Personality showed no significant difference between the experimental and control groups.

Although the results showed a lack of empirical data to support benefits of peer tutoring, anecdotal material related many positive benefits. Throughout the project, teachers and students described increases in computer skills and benefits to working and learning cooperatively with other students.

This project was extremely rewarding and provided opportunities for disabled students and teachers that would not be available by any other means. The project start-up was slower than anticipated and progress through different software took much longer. Many more sessions were spent on word processing than planned; a simulation/problem solving software program called *Car Builder* captured the students' attention and imagination so much that additional time was spent on this program. Experience has shown that it is preferable to concentrate on fewer pieces of software and use these pieces as examples of skills that could be readily learned and transferred to other programs once they are mastered.

The project was repeated during the 1987-88 and 1988-89 school years under the supervision of two special education teachers. The students involved were orthopedically and visually impaired students, ninth through twelfth grade, in an inner-city high school.

APPENDICES

APPENDIX A
THE ECCO EQUITY IN TECHNOLOGY PROJECT

ECCO's Equity in Technology Project addressed three populations in which inequities in computer use and access existed—females, minority/economically disadvantaged students, and students with either physical or developmental handicaps. Each of these populations had special needs and required different strategies to meet these needs.

One of the first goals of the Equity in Technology Project was to raise the level of awareness on the part of teachers and administrators to the inequities that existed. Frequently these inequities were subtle and required a "consciousness-raising" type of approach. Teachers were unaware of how inequities manifested themselves or where they originated.

Some inequities had their roots in the schools. A teacher asking for a "strong boy to carry a computer" didn't realize that a message was being sent to the girls that computers were for boys. Computer classes offered through the math departments discouraged all but the mathematically competent students from enrolling in computer classes. A computer camp director, advertising a camp program for boys and girls, produced a brochure that contained pictures of boys only. Although the body of the text described camping opportunities for girls and for minority students, the pictures told a different story.

Some inequities originated in the media. Computer journals that pictured only white males on their covers portrayed the computer culture in a way that tended to exclude women and minorities. Television commercials that showed white computer-using males painted a picture of who uses computers and who does not.

There were frequently inequities in the home. Parents tended to purchase computers for their sons rather than for their daughters. In homes that had computers, fathers, rather than mothers, used them. In less affluent homes there simply weren't any computers.

In the case of students with handicaps a different set of circumstances prevailed. Students with physical handicaps frequently couldn't get to the computers, or having gotten there, couldn't use the computers without adaptive equipment. Students with developmental handicaps didn't have access to computers which, in some schools, were reserved for the brighter students or those students who finished their other work quickly and were rewarded with time on the computer. Schools with limited equipment placed their computers in labs that often were not available to special education students or students with learning disabilities.

No single factor created the inequities we saw. Rather, it was a cumulative effect, reinforced in many areas, which sent a clear message to girls, to minority students, and to students with handicaps that computers weren't for them.

The ECCO Equity in Technology Project focused on classroom teachers. In order to develop their projects, they first had to identify inequities that existed in their schools and then create strategies to alleviate them. We found that we needed to provide educational programs to help teachers understand the problems and their possible solutions. Since administrative support was vital to the success of the projects, we invited superintendents of schools to attend an opening reception at which the Equity in Technology Project was described along with an explanation of how their schools could be involved.

The Equity in Technology Project has now funded 57 Local Action Projects. During the years in which ECCO has administered the program, we have learned that classroom teachers can devise creative and innovative solutions, and

that with a minimum of support, they can develop programs of real worth and excellence. The balance of this chapter describes the project design. It can be adapted to any setting. It is our hope that other states or districts will implement their own Equity in Technology Project.

Project Description

The Equity in Technology Project was designed to meet five specific goals:

1. Raise the awareness level of educators of the inequities that exist in computer education, stressing the type of computer usage, as well as the amount of usage.
2. Help teachers identify specific inequities that exist in their schools and classrooms.
3. Help teachers to develop and implement strategies to overcome those inequities.
4. Encourage means by which those teachers can serve as role models for others.
5. Develop a resource center through which educators can learn more about computer inequities and their solutions.

To implement its goals, the Equity in Technology Project was divided into three phases: **Education, Implementation, and Dissemination**.

During the *Education Phase*, several workshops designed to train educators to overcome computer inequities were presented throughout Ohio. A request for proposals was tendered to all teachers who attended the workshops. During the *Implementation Phase*, the project leaders (the grant winners) integrated new strategies and techniques into their curriculum. During the *Dissemination Phase*, print and electronic materials involving computer equity were compiled into a resource library and made available for dissemination to interested groups and individuals.

Announcing the Project

The Equity in Technology Project was announced to educators throughout the state. All superintendents and curriculum directors in the state were invited to a reception to familiarize them with the Equity in Technology Project. The school administrators had an opportunity to hear the details of the project and to ask questions. Workshop registration forms were available for their teachers.

An Equity in Technology informational brochure was mailed to every school district in the state. The brochure described the project and the workshops, and included a registration form for the workshops. Approximately 500 teachers attended workshops held in five cities. Although the workshops focused on a specific group—minorities/economically disadvantaged, handicapped, or female—the techniques to identify inequities and the strategies to overcome them could often be adapted from one group to another. Workshop participants were encouraged to develop specific computer equity projects for their classes. Each participant was given an application for an Equity in Technology grant and encouraged to apply.

Workshops

Playing to Win

Playing to Win, Inc. is a unique nonprofit organization based in East Harlem, New York. It is dedicated entirely to promoting educational computer use for those at an economic or social disadvantage. Antonia Stone, founder and director of Playing to Win, conducted the first workshop for the Equity in Technology Project. The full-day workshop was divided into four modules.

The first, Identifying the Problem, presented an overview of current research and involved group participation in role playing and discussion. Participants identified routine activities in their classrooms that resulted in subtle inequities.

The second workshop module identified resources for teachers. Participants were introduced to literature, electronic media, and organizations that offer tried and tested ideas, strategies, and software designed to break the social barriers that come between minority and disadvantaged children and computers.

During the third workshop module, participants worked in small groups to devise action plans to implement in their own schools.

In the fourth module, participants offered one another constructive criticism and evaluation.

Closing the Gap

Closing the Gap is a resource center based in Henderson, Minnesota, dedicated to using computer technology to help the handicapped. Budd and Delores Hagen, founders and directors of Closing the Gap, presented a day-long workshop for the Equity in Technology Project. The workshop began with a videotape presentation of handicapped youngsters using adaptive hardware devices. The presentation brought home with great force the fact that computers can be a bridge to communications for the handicapped. From that beginning, the Hagens described and demonstrated hardware and software that were designed or could be adapted to the needs of the handicapped. Emphasis throughout the workshop was on identifying the needs of the individual and adapting computer technology to serve those needs.

Equals in Computer Technology

EQUALS in Computer Technology is based in the Lawrence Hall of Science at the University of California at Berkeley. Kay Gilliland, director of EQUALS in Computer Technology, and Renee Wilkerson presented two workshops for the Equity in Technology Project.

The first workshop was designed for teachers and administrators, potential grant applicants. "Startling Statements" were used to highlight the discrepancies between male and female achievements based in part on computer literacy. The reasons for the discrepancies were explored, and the need for cooperative rather than competitive activities was discussed. Throughout the day, participants engaged in cooperative activities that could be adapted to classroom use in all grade levels.

The second workshop was for a select group of educators who desired to become trainers in the EQUALS philosophy

of computer education. The intense two-day workshop highlighted strategies and resources for teachers. Techniques were presented to make workshops interesting and meaningful. Every workshop participant carried back with him or her a heightened awareness of equity issues, the means to identify inequities in his or her classroom, and strategies to overcome those inequities.

Selecting the Project Leaders

Applications for funded projects were distributed to participants at the equity workshops. In addition, the availability of applications was announced through *The Output*, the ECCO newsletter. Of the more than 100 applications received, 11 projects were awarded grants of $2,000 to $3,000. One additional project was not funded, but was the recipient of a loan of 10 Acorn computers and Acorn software. The 12 projects represented a state-wide geographical distribution. Four projects targeted minority/economically disadvantaged students, three targeted female students, three targeted learning disabled students, and two targeted physically handicapped students.

Appendix B
Equity in Technology Project Leaders

Jo Ann Berkowitz
Mansfield City School
"Improving Composition Skills of Low Incidence Handicapped Students"

Virginia Browsh, Dr. Thomas Morgan, Donald Hatfield
Cincinnati City Schools
"Communications Pilot Project"

Thomas Diamantes
Cincinnati City Schools
"The Improvement of Language Arts and Social Studies Skills Among Economically Disadvantaged Minorities by Computer Assisted Instruction"

Janis Elliott
Washington Local School District
"Sex Equity in Computer Education"

Ann Fazzini
Talawanda City Schools
"Using the Computer to Increase Academic, Vocational, and Social Skills of Junior High Occupational Work Adjustment (OWA) Students"

Joanne Guay
Brunswick City Schools
"Targeted Technology Teams"

Dr. Trish Koontz
Kent State University
"E (p) = ERG: Potential Energy = Enrichment Readiness for Girls"

Laurie Kuchmaner
Trumbull County Board of Education
"The Write Way"

Marlene McMillan
Cleveland Public Schools
"Preparation for Success (PREP)"

Sr. Mary John Paul Boback, Sr. Geraldine Tengler
Cleveland Catholic Diocese
"Working Together in Word Processing"

Lois de la Pena
Cleveland Heights-University Heights City Schools
"Usage by Learning Disabled Students, An Exploration"

Madeline Rosenshein
Cuyahoga Special Education Service Center
"Hands On—A Training Model for Peer Tutors"

Appendix C
National Advisory Board

The National Advisory Board determined policy, provided advice and counsel to the Project staff, selected grant recipients and served as mentors to project leaders. Each member of the Advisory Board was a recognized leader in the area of technology and/or equity issues. They were indispensable to the successful implementation of the project.

Dr. Ronald Anderson
University of Minnesota

Phyllis Benjamin
Cleveland Public Schools

Joie Drouhard
IBM

Nancy Eberhart
Ohio Department of Education

Dr. Carolyn Elliott
University of Vermont

Kay Gilliland
EQUALS in Computer Technology
University of California

Dr. Cora Marrett
University of Wisconsin

David Mathis
BP America
Cleveland, Ohio

Dr. Jo Sanders
Computer Equity Training Project
New York, New York

Leslie Wolfe
Center for Women Policy Studies
Washington, D.C.

Appendix D

ECCO

The Educational Computer Consortium of Ohio

Background

ECCO, the Educational Computer Consortium of Ohio, was founded in 1979 to provide professional support to schools and teachers who were beginning to introduce computers in the educational setting. From a small beginning, ECCO has grown into a major state-wide organization of 80 school districts, and over 1,000 individual and family members. Universities, nonprofit organizations and computer related businesses are also part of ECCO. ECCO is located in Cleveland, Ohio.

Resource Center

ECCO maintains a comprehensive Resource Center of computer related materials. The commercial software collection contains over 1,000 software programs to support the most commonly used computers in schools and homes. Members may borrow these programs for previewing and for use in their schools or homes. The public domain software collection contains approximately 3,000 noncopyrighted programs that members can copy. In addition, the Resource Center includes hundreds of circulating items such as computer books, journals, newsletters, and curriculum guides, and audio-visual materials such as videotapes, filmstrips, and teaching aids.

Computers

ECCO houses an Apple IIc lab plus Apple IIe and IIg, Macintosh, IBM, Commodore, Atari, and Tandy computers for members' use.

Staff Development

Staff development activities, both credit and noncredit, are offered throughout the year. They include workshops, seminars, conferences, and demonstrations for teachers, administrators, and school support staff.

Computer Fairs

Each October, ECCO holds an annual Educational Computer Fair with nationally known speakers, over 60 separate workshops, demonstrations, hands-on sessions, and a large vendor display. In May, ECCO holds its annual spring conference.

The Electronic Schoolhouse

In cooperation with Cleveland Free-Net, the nation's first public access telecomputing bulletin board system, ECCO has helped to create and promote the Electronic Schoolhouse. Telecommunications is an important part of new project designs, including the Equity in Technology and the Microcomputer-Based Laboratory Projects.

Publications

The Output

The Output, ECCO's bimonthly newsletter, provides information on all of ECCO's activities and contains special feature columns.

The ECCO Logo Project

The ECCO Logo Project: Materials for Classroom Teachers and Teacher Trainers presents Logo activities for use in grades four through eight. It was edited by Theodore C. Burrowes and Sharon Burrowes Yoder and published by ISTE.

Special Projects

ECCO periodically engages in special projects to enhance the use of computers in education. Current projects include the **Microcomputer-Based Laboratory Project,** and **Equity in Technology,** the focus of this publication.

Past projects include **"Take Home a Computer—Computer Literacy for Teachers," The Great Lakes/East Coast Logo Conference, ECCO Logo Project,** and **"Hands-On: An Introduction to Computer Literacy,"** a program for public school children.

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For more information contact ECCO, 1123 SOM Center Road, Cleveland, Ohio 44124. Phone: 216-461-0800. The director of ECCO is Alice Fredman.

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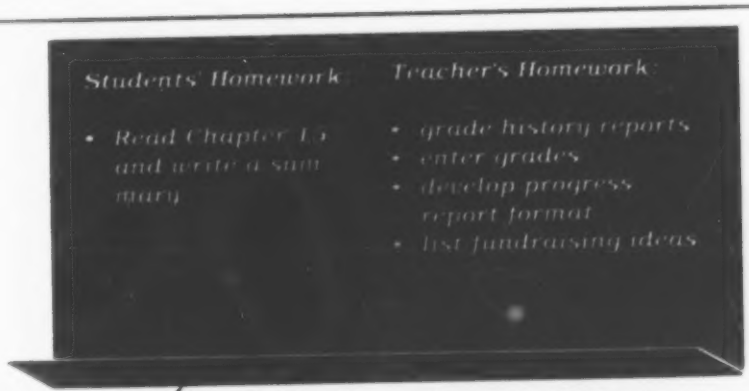
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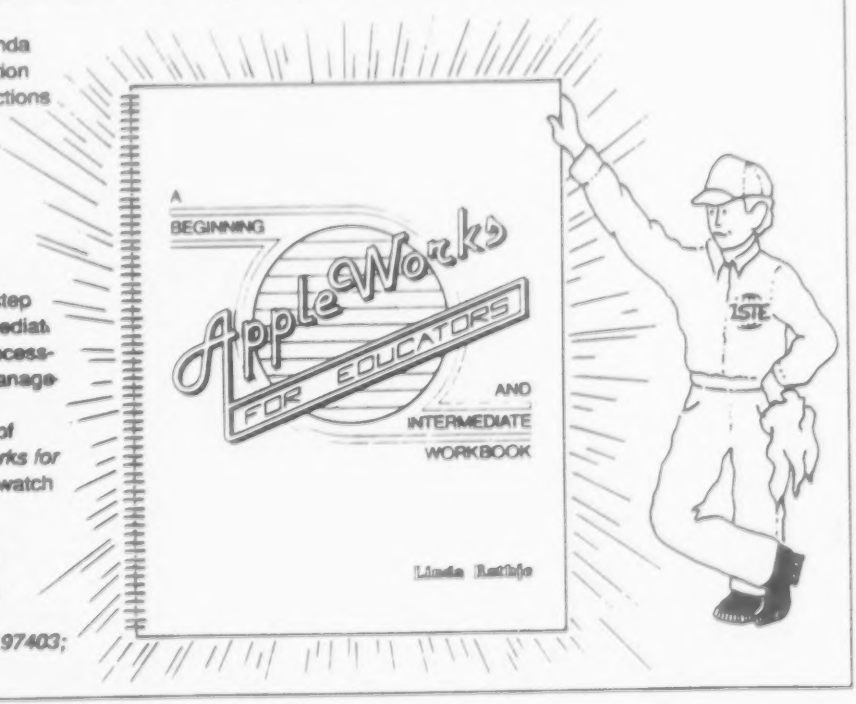

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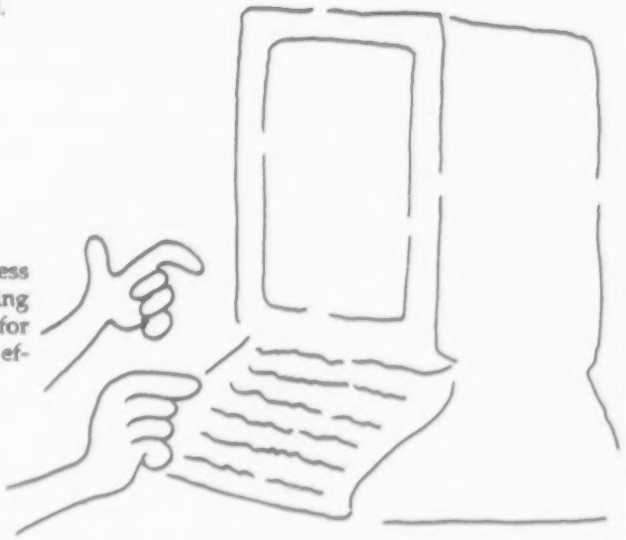

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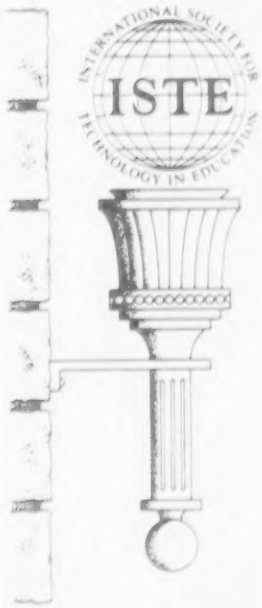

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